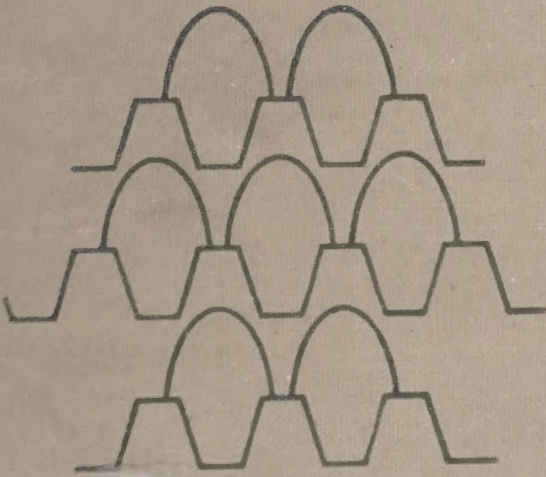
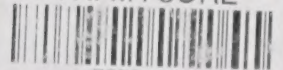




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Marketing poultry



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MARKETING
POULTRY
PRODUCTS

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Earl W. Benjamin, Ph.D.

Consultant, Agricultural Relations, Branchport, New York

James M. Gwin, Ph.D.

Manager, Poultry Marketing Division,
Ralston Purina Company, St. Louis, Missouri

Fred L. Faber, M.S.

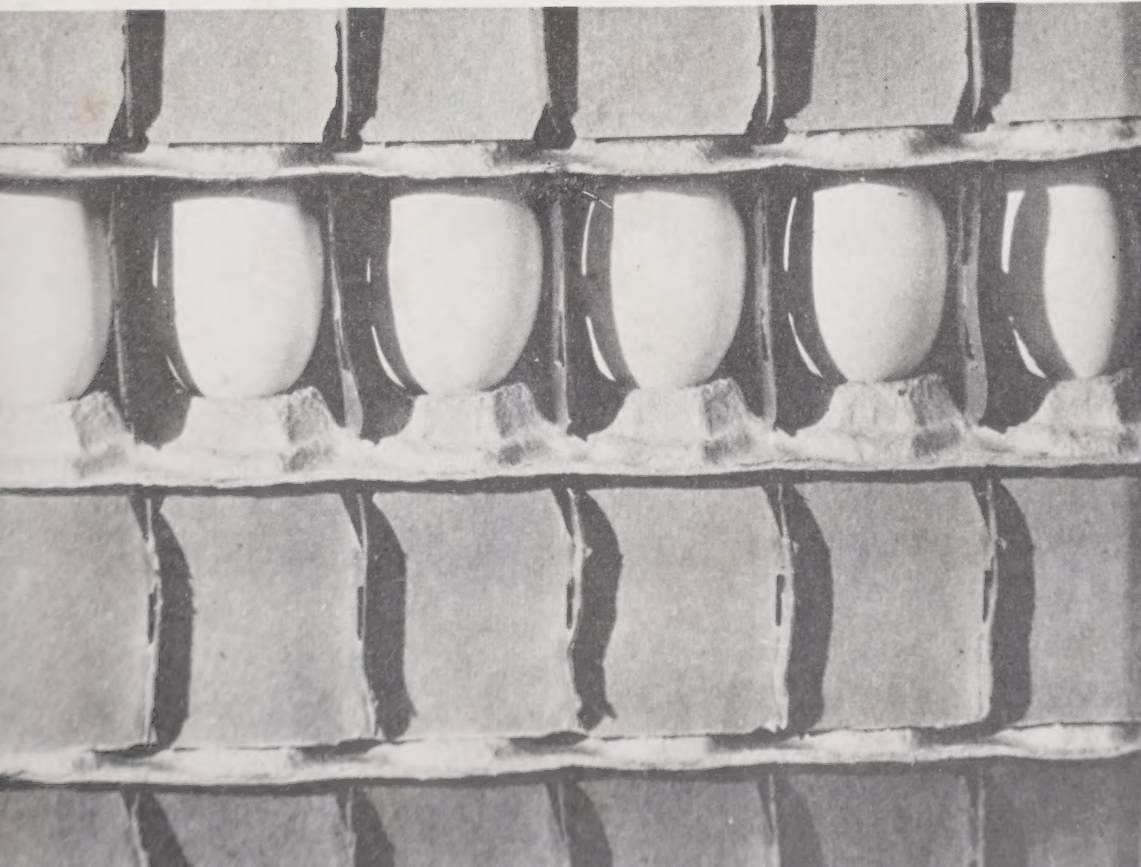
Agricultural Economist,
U. S. Department of Agriculture, Washington, D. C.

William D. Termohlen, M.S.A.

Economic Consultant and Lecturer, Hendersonville, Tennessee

5th
edition

MARKETING POULTRY PRODUCTS



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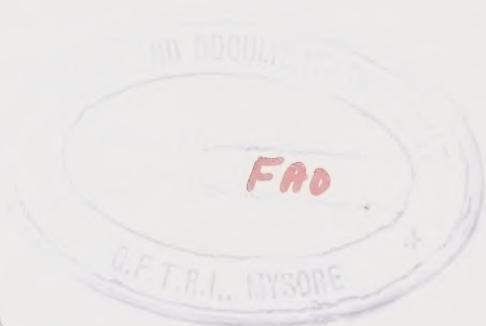
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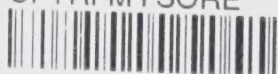
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Marketing poultr..

We affectionately dedicate this book to the late James E. Rice, formerly Professor of Poultry Husbandry and Head of the Department of Poultry Husbandry at Cornell University. Professor Rice was internationally recognized as a great leader and teacher. To him and to his teachings we acknowledge credit for the inspiration and incentive we needed in the preparation of this book.

Preface

The dreams of both students of marketing and practical market operators in the egg and poultry field have been coming true rapidly during the decade since we published the fourth edition of this book. In recent years no phase of the industry has remained untouched by the wave of automation, concern for the consumers' needs, and readiness to test and adopt new ideas and new methods. Whereas research, both governmental and private, has led the way, the high cost of labor and the need for handling increased volume at decreased costs per unit have pushed this evolution along at a rapid pace.

In this fifth edition of *Marketing Poultry Products* we try to bring the students and other readers abreast of the changes that have taken place. We have also undertaken to point out trends to help readers foresee the future in whatever phases of the field command their interest. Major responsibility for Chapters 3, 12, 14 and 16 was assumed by James M. Gwin. Major responsibility for the remaining chapters and the portion of Chapter 12 on "Marketing Margins and Costs" was assumed by Fred L. Faber. Mr. Termohlen, one of the authors of the fourth edition of this book, was of great help in the early preparations for this edition. Mr. Termohlen retired from the U. S. Department of Agriculture in 1959 after 26 years of active service in domestic and foreign fields. Although the name of Howard C. Pierce does not appear among the authors of this edition of *Marketing Poultry Products*, the inspired contributions he made to the two previous editions have helped to assure the worthiness of this fifth edition. Much use has been made of his material and ideas in bringing this new book to completion.

For students of marketing, whether already engaged in distribution operations or preparing for research, teaching, or the practical field in colleges or schools of Vocational Agriculture, we have added review questions and, where it is needed, a list of supplementary reading at the end of each chapter. Reference numbers throughout the text refer to a selected bibliography at the end of the book. By these aids the readers may pursue their inquiries further.

With the help of persons actively engaged in teaching vocational agriculture, we have tried particularly to adapt this fifth edition to the needs of the teachers and students in agriculture schools.

EARL W. BENJAMIN

JAMES M. GWIN

FRED L. FABER

WILLIAM D. TERMOHLEN

Branchport, New York

March, 1960

Acknowledgments

Since the field of marketing egg and poultry products is broad, the specializations within each separate branch of activity are sharply defined, and changes are rapid, we felt that a comprehensive treatment of the subject could be accomplished best by calling upon experts in each branch of study for criticism and supplementary material. To give assurance that the text is well adapted to use in schools for training in vocational agriculture, the material has been especially reviewed, and questions have been appended to each chapter by Robert R. Stockbridge, B.V.A., Associate Professor of the State University of New York Agricultural and Technical Institute at Farmingdale, N. Y. Professor Stockbridge has successfully engaged in vocational training in Poultry Husbandry since 1937.

We have looked to men in the practical fields of operation—teachers, research workers, and governmental staff members—for guidance, information, and criticism. Although these men have helped greatly in the preparation of the manuscript, we wish to emphasize the fact that these consultants should in no way be held answerable for any part of the finished book. That responsibility rests solely with us.

Men engaged in commercial operations, to whom we wish to express our sincere appreciation include Berwyn Gehgan, C. Waldo Haldeman, E. C. Heinsohn, Gordon Umer, and B. Zuckerman. From among the teachers and research workers special thanks are due to Professors J. H. Bruckner, A. William Jasper, O. F. Johndrew, Jr., J. W. Koudele, W. P. Mortenson, and W. H. Thompson.

Because we found them qualified and willing to help, we requested and received reviews of chapters and other assistance from government workers, experts in their respective fields, to assure complete and accurate coverage in the various areas of activities dealt with in this book. These men, including some who have since left government service, to whom we wish to acknowledge our special appreciation, are: K. D. Akers, M. Banks, Edward R. Baush, Henry W. Bradford, A. W. Brant, P. Breakiron, R. S. Cotter, Edward Drewniak, H. W. Ford, J. O. Gerald, G. Goldsborough, John Hamann, E. H. Hansen, W. E. Hauver, J. Herrick, Jr., H. S. Kahle, Edward Karpoff, L. Kil-

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Appropriate cuts and data for tables needed to clarify important portions of the text have been supplied most graciously by individuals, institutions, governmental agencies, and commercial operators. We are most grateful for all such aids and have undertaken to establish credit either in the text or in the bibliography.

And finally, the successful preparation of this book has to no little degree been due to the skillful and tireless work of Ethel Kaelin. Her correcting and typing of the manuscript, consultations with the publishers, and general editing assistance were invaluable.

E. W. B.

J. M. G.

F. L. F.

W. D. T.

Contents

1. The Egg and Poultry Industry	1
2. Marketing Channels and Activities of Handlers	16
3. Demand for Eggs and Poultry	34
4. The Egg	41
5. Grading and Packing Shell Eggs	66
6. The Egg Products Industry	93
7. Marketing Live Poultry	112
8. Processing Poultry	125
9. Grading and Packing Poultry	151
10. The Poultry Products Industry	163
11. Transporting and Storing Eggs and Poultry	174
12. Merchandising and Retailing Eggs and Poultry	201
13. Prices and Market Information	226
14. Promotion and Advertising	247
15. The Producer as a Market Factor	262
16. Egg and Poultry Legislation	281
Appendix	295
Bibliography	313
Index	319

The Egg and Poultry Industry

The production of eggs and poultry is rapidly emerging from an era of small farm flocks and is well into a stage of development characterized by large, specialized flocks. In marketing, similar developments have occurred. The small poultry processor is finding it difficult to compete with the large processor. In turn the large processors are finding it necessary to increase their efficiency by using automatic machinery and the best materials handling methods. Egg marketing is proceeding through a similar evolution.

During the latest year for which census data are available, chickens were reported on 3.4 million or 71 per cent of the 4.8 million farms in the United States.^{60*} Through the years there has been a definite downward trend in both the number of farms reporting chickens and in the total number of farms. In 1910 chickens were reported on 5.6 million (or 88 per cent) of the 6.4 million farms in the United States. Although there has been a decline in the number of farms reporting chickens, there has been an increase of 50 per cent in the total number of chickens since 1910. At the same time the numbers of ducks and geese increased moderately, and there has been a substantial increase in turkeys.

Another measure of the importance of the industry is the money received from the sale of farm products. In recent years egg and poultry products accounted for more than 3 billion dollars, or about 10 per cent of the sales of all farm products. Through the years poultry and eggs have exhibited considerable stability as contributors to farm income by usually accounting for 10 or 11 per cent of gross farm income. Similarly, stability has been shown in the ranking of poultry and eggs among all farm products. Poultry and eggs typically rank third as a source of gross farm income and are exceeded only by the income from meat animals and dairy products.

Within the poultry and egg industry eggs rank first, commercial broilers second, turkeys third, and farm chickens fourth as contributors

* Superior numbers refer to items in the Bibliography beginning on page 313.

Table 1. Gross Farm Income * for Eggs, Farm Chickens, Commercial Broilers, Turkeys, and Other Poultry, United States 1940-1944, 1945-1949, 1950-1954, and 1955-1958

Item	1940-44		1945-49		1950-54		1955-58	
	Million Dollars	Per Cent	Million Dollars	Per Cent	Million Dollars	Per Cent	Million Dollars	Per Cent
Eggs	1164	56	1964	58	2032	56	1905	55
Farm chickens	559	27	750	22	475	13	243	7
Commercial broilers	161	8	353	10	702	20	893	26
Turkeys	138	7	256	8	330	9	326	10
Other poultry †	33	2	53	2	59	2	57	2
Totals	2055	100	3376	100	3598	100	3424	100

* Gross farm income includes cash receipts from sales and the value of the products consumed in households of producers.

† Other poultry includes ducks, geese, guinea hens, etc.

Source: Computed from data presented in the *Poultry and Egg Situation*, U.S.D.A., AMS, May 1959.

to gross farm income from poultry products in recent years (Table 1). Although the importance of eggs as a contributor to cash farm income has declined slightly during the last 15 to 20 years, eggs still account for more than half of the total. The outstanding change has occurred in commercial broilers. During the years 1940-1944 commercial broilers accounted for only 8 per cent of the 2 billion dollars in gross farm income from poultry products. By 1955-1958 they had risen to 26 per cent of the more than 3 billion dollars of gross farm income from poultry and eggs. The rise in gross farm income for broilers was both in dollars and in per cent of total. Gross farm income from farm chickens declined by almost one half in total dollars from 1940-1944 to 1955-1958 and in per cent of gross farm income declined from 27 to 7 per cent. Turkeys showed only a moderate increase from 7 per cent in 1940-1944 to 10 per cent in 1955-1958 as a contributor to gross farm income. "Other poultry," including ducks, geese, and guinea hens, as a contributor to gross farm income has remained at 2 per cent.

SOURCES OF SUPPLIES

General farm flocks of poultry will continue to persist in some parts of the United States, but there has been a growing trend toward specialization and commercialization in the production of eggs and poultry meat. Through the years, this trend has resulted from improvements made in breeding, feeding, disease control, production management, and marketing. Greater efficiency in production and marketing practices has enabled the products of the industry to compete favorably with other protein sources for the consumer's dollar.

Eggs

During 1954-1958 the West North Central and East North Central regions (Fig. 1) ranked first and second respectively by producing almost half of the 60 billion eggs produced in the United States; the North Atlantic region ranked third, and the Western region fourth (Table 2). In general the southern half of Minnesota and the northern half of Iowa are the heart of the heavy surplus production area of the West North Central region.

During the last twenty-five years important trends have become evi-



Fig. 1. Six regions of the United States as usually divided for statistical discussion.

Table 2. Farm Production of Eggs, Farm Chickens, Commercial Broilers and Turkeys by Regions, 1954-1958; and Estimated * Production of Ducks and Geese by Regions, 1954

Region	Eggs, Millions	Farm Chickens		Commercial Broilers		Turkeys,	Ducks,	Geese,
		Million Pounds	Million Pounds	Million Pounds	Million Pounds	Million Pounds	Million Pounds	Million Pounds
North Atlantic	10,928	288	562	77	37.4	1.0		
East North Central	11,812	343	284	168	14.2	2.5		
West North Central	16,502	465	129	344	6.5	5.3		
South Atlantic	5,749	172	1,822	167	2.1	0.7		
South Central	7,498	189	1,162	136	2.5	3.3		
West	7,596	163	235	350	3.7	6.0		
United States	60,085	1,620	4,194	1,242	66.4	18.8		

* Estimated farm production of ducks and geese was obtained by multiplying the number raised as reported in the 1954 Census of Agriculture by an average live weight of 6 pounds for ducks and 11 pounds for geese.

Sources: Computed from data in farm production, disposition, cash receipts, and gross income reports of the U.S.D.A. and the 1954 Census of Agr., U.S. Dept. of Commerce.

dent in egg production.⁶¹ Two of these have been mentioned earlier: (1) the decline in the number of farms with chickens and (2) the increase in total production. Although others are discussed briefly below, a more detailed analysis of these trends is available in the supplemental reading at the end of this chapter and in references to the bibliography. Trends are not always infallible indicators of the future, but they do reflect underlying causes and developments such as improvements in breeding, feeding, and disease control. Similarly trends in marketing reflect changes in market structure; reductions in the costs of processing, transporting, and storing; shortening the chain of handlers; and integration of marketing functions.

Size of flock. In 1930 farms with flocks of less than 50 chickens accounted for 17.5 per cent of the chickens on hand, and farms with 400 or more accounted for 13.3 per cent of the chickens on hand. By 1954 a sharp contrast was revealed because farms with flocks of less than 50 chickens had only 7.4 per cent and farms with 400 or more had 44.1 per cent of the chickens on hand. In fact farms with 3,200 or more in the flock accounted for only 0.3 per cent of the farms, but they had 12.1 per cent of the chickens. This shift occurred even

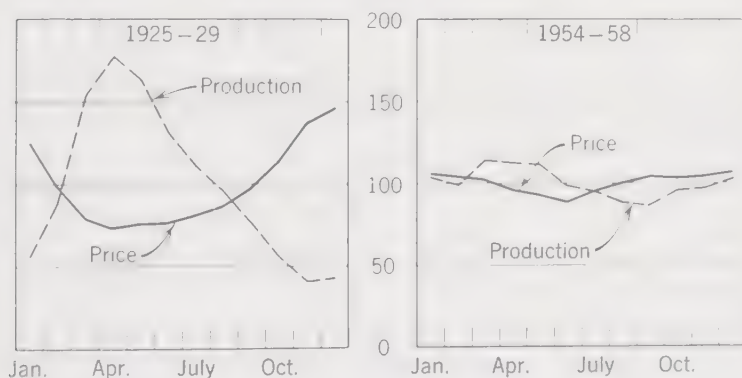
though there was a 10 per cent decrease in chickens on farms from 1930 to 1954 according to the census of agriculture.⁶⁰

Rate of lay. During 1925–1929 only 93 eggs were produced per potential layer on the average for the entire United States. Twenty-five years later the figure had risen to 148, and in 1958 it stood at 172. The largest increases were made in the West North Central and the South Central regions. The increases in rate of lay have been responsible for the increases in eggs produced because numbers of chickens have declined.

Seasonality of production. The old pattern of high egg production in the spring and low egg production in the fall and winter has been leveling through the years. As a result the reverse pattern of low egg prices in the spring and high egg prices in the fall and winter also has been leveling (Fig. 2). Underlying this trend are improvements in breeding for year-round production, feeds with supplements of vitamins and minerals, and poultry housing for 100 per cent confinement. This trend has also reduced the need for storage of shell eggs and increased the need for marketing services such as grading, packing, and transportation on a year-round basis.

Farm Chickens

The term “farm chickens” includes hens, roosters, and a variety of miscellaneous young stock which are likely to be found on general



February Production Data Adjusted for Length of Month

Fig. 2. Seasonality of egg production and prices—percentages of the 60-month average. Seasonal swings in egg production are smoothing out, and with them, seasonal swings in egg prices. By producing a larger proportion of eggs during the months when prices have historically been higher than average, farmers are reducing the amounts by which prices in those months exceed the annual average. (Adapted from U.S.D.A. data.)

farms, such as broilers, fryers, roasters, capons, and pullets. It excludes commercial broilers. "Mature farm chickens" is another term that is used when referring to hens and roosters, and "young farm stock" is used to include broilers, fryers, and roasters.

Farm chickens are raised primarily for the purpose of producing eggs. When the cash farm income from eggs and farm chickens is combined it can be observed that eggs accounted for almost 90 per cent of the total in 1955-1958 (Table 1). Because of this relationship it is not surprising that the geographical distribution of production for farm chickens is similar to the one discussed earlier for eggs.

Two important industry trends have occurred that have influenced the production of farm chickens. First, the increase in rate of lay has resulted in a decrease in the need to raise farm chickens because fewer hens are needed to produce the eggs consumers demand. Second, there has been a strong trend by egg producers toward the purchase of sexed pullet chicks, when chicks are purchased for egg production purposes. It has been estimated that 21 per cent of egg-type chick purchases were sexed pullets in 1942, and this number rose to 65 per cent in 1958. The decline in the need to raise farm chickens for the purpose of producing eggs has resulted in a decline in the production of poultry meat from the farm chickens raised.

The sale of poultry meat from old hens and roosters is mainly a by-product of egg production and in some of the recent years many producers have found it difficult to sell old hens and roosters at profitable prices. Less than half of the poultry meat supplied by farm chickens is produced from "young farm chickens." The general farm operators who have raised broilers, fryers, roasters, and capons along with the pullets for egg production have faced stiff competition from producers who have specialized in producing poultry meat in the form of commercial broilers and fryers, turkeys, and ducks.

COMMERCIAL BROILERS

Developments in the production and marketing of commercial broilers are probably the most spectacular in the field of agriculture during the past 25 years. Although there are many early references to "hot house broilers" and "winter broilers," the modern commercial broiler industry began its rapid growth in the mid-thirties. Twenty-five years later this industry produced over 4 billion pounds of poultry meat, 40 per cent more than the combined production of farm chickens.

turkeys, ducks, and geese (Table 2). During 1954-1958 the South Atlantic Region produced almost half of the broilers, the South Central Region ranked second, and the North Atlantic Region ranked third. The production areas for commercial broilers, which are relatively small and compact, are concentrated in parts of states. In 1958 North Georgia ranked first, and the Delmarva peninsula (the peninsula consisting of portions of Delaware, Maryland, and Virginia) ranked second. Other important commercial broiler areas are in Alabama, Mississippi, central and western North Carolina, the two northwestern counties of Arkansas, the Shenandoah Valley of Virginia and West Virginia, Southern Maine, East Texas, and parts of Connecticut, California, and Indiana.

The concentration of production in relatively small areas has attracted allied industries such as hatcheries, feed suppliers, slaughtering plants, and trucking companies. This in turn has led to an integration of production and marketing functions. A number of the state agricultural experiment stations have studied the development of financing and integration in the industry, and a recent publication summarized these studies.⁴

Some of the other important trends concern improvements in feeding, breeding, disease control, management, and processing. Ten years ago 3.5 pounds of feed were needed to produce a pound of finished broiler; now 2.5 pounds or less of feed are needed, and newly developed high fat feeds hold a promise of further reductions. Fast growing hybrid crosses have reduced the time needed to produce a finished broiler from 14 to 9 weeks. Ten years ago a mortality rate of 10 per cent was common, but now it has been reduced to less than half that amount.

Ten to fifteen years ago broilers were raised in relatively small flocks and farmers raised only 3 broods per year. In contrast the 50,000 farms reporting sales of broilers in 1954 had average sales of 21,000 birds per farm. Many individual producers now raise 10,000 to 15,000 broilers per brood, five times a year. In a large measure automatic watering and feeding equipment has made this possible. Slaughtering plants have increased their capacity as new equipment and larger supplies of poultry have become available. All of these factors, which have reduced the cost of producing and marketing each pound of broiler, have been largely responsible for the rapid growth of the industry. However, consumer acceptance of the product has been important also, because consumers have learned that a tasty, wholesome, high quality product has become available at attractive prices.

Turkeys

More than a fourth of the turkeys are produced in the Western Region; the West North Central Region is a close second, and the East North Central Region ranks third (Table 2). In 1929 the average number of turkeys raised per farm was only 26. However, competition has also forced this industry to specialize. A drastic reduction has occurred in the number of farms raising turkeys, whereas the total number raised has increased almost four times from 1929 to 1954. As a result the average number raised per farm stood at 370 in 1954. Flocks of 5,000 to 15,000 birds are typical in the important production areas.

Although production has increased through the years, there has been a shift in the relative importance of the areas of production. The South Central Region has shown the largest decline, whereas the Western Region has shown the largest increase.

Ducks

Although the total amount of poultry meat produced by raisers of ducks is not large in comparison with chickens or turkeys, the number of ducks raised has remained relatively stable from 1929 to 1954 at approximately 11 million birds per year.⁶⁰ However, during the same period the number of farms reporting ducks declined by more than 50 per cent. The size of individual farms varies from a few thousand to over 200,000 head annually.

The North Atlantic Region produces almost half of the ducks raised (Table 2). The producers at the eastern end of Long Island in New York State supplied 4,970,000 of the 11,065,000 ducks raised in the United States in 1954. Another important area within this region is Massachusetts, but the production there is only a tenth of the New York production. Other important duck producing areas are in Illinois, California, Iowa, Minnesota, and Michigan.

Geese

The number of geese raised in 1954 was 1.7 million, or about 15 per cent of the number of ducks raised. However, geese are heavier birds than ducks, and on a weight basis the poultry meat produced by growers of geese was approximately a third of that produced by growers of ducks (Table 2).

The number of geese produced declined from 4 million in 1929 to 1.7 million in 1954. During the same time period the number of farms raising geese declined by almost 75 per cent.⁶⁰

The Western Region produces the largest number of geese, and within that region California is the largest producer. The West North Central Region is second, and within that region Minnesota and Iowa are the most important producing states.

In addition to the poultry meat produced, the growers of ducks and geese also produce an important by-product. Water fowl feathers have considerable value in the manufacture of bedding and furniture. The value of the feathers is often enough to offset the costs of dressing poultry. During periods of military activity water fowl feathers become a critical material because of their use as an insulator in sleeping bags, aviator's jackets, and the like.

THE MARKET FOR EGGS AND POULTRY

The United States is the most important market for eggs and poultry. There has been considerable effort expended in promoting these products in foreign markets with some increase in exports in recent years, but still the proportion of total production exported is small. Nonfood uses of egg and poultry products are very limited.

The Domestic Market

Growth of population in the United States averages between 1 and 2 per cent per year. The market for poultry products increases accordingly. However, the amounts actually taken out of the markets by consumers vary with many factors which will be discussed later, in the chapter on demand.

Most of the major cities are long distances from the important production areas for poultry and eggs. Basically, the functions performed in marketing are to bridge this gap between producers and consumers by offering the products in the form, time, and place desired by consumers.

A measure of the importance of the marketing job is found in the per capita production patterns by regions. These are obtained by simply dividing the eggs or pounds of poultry produced by the number of people. Regions that have a higher per capita production than the United States average are designated as surplus, and regions that have a lower per capita production than the United States average are designated as deficit. There is regional variation in consumption, of course, but this measure provides a basis for making broad comparisons.

For eggs, the regions most deficit are the South Atlantic and North Atlantic. All of the remaining regions are also deficit, except the West

North Central (Table 3). In fact the West North Central Region produces three times as many eggs as it needs. It supplies shell eggs to the other regions and also furnishes eggs for the production of frozen eggs and egg solids. The largest movement of eggs is from the West North Central Region to the North Atlantic, South Atlantic, and South Central Regions. This movement, which occurs in fact, is indicated by the relationships in the lower portion of Table 3. During the past 25 years the North Atlantic Region has become less and less deficit. The East North Central and the Western Regions have shifted from surplus to deficit; and the South Atlantic Region has become more deficit. Trends in both population and production have accounted for these shifts. Mortenson ⁶¹ has made a detailed study of these and other trends.

The largest deficit areas for commercial broilers are the East and West North Central Regions. These areas are closely followed by the Western and North Atlantic Regions. There is a large movement of broilers to these regions from the surplus production areas of the

Table 3. Per Capita Production of Eggs, Farm Chickens, Commercial Broilers, and Turkeys 1954-1958, and Ducks and Geese, 1954, by Regions

Region	Eggs, Number	Farm Chickens, Pounds	Com- mercial Broilers, Pounds	Turkeys, Pounds	Ducks, Pounds	Geese, Pounds
North Atlantic	261	6.9	13.4	1.8	0.91	0.02
East North Central	346	10.0	8.3	4.9	0.44	0.08
West North Central	1,106	31.2	8.6	23.0	0.45	0.37
South Atlantic	244	7.3	77.4	7.1	0.09	0.03
South Central	274	6.9	42.4	5.0	0.09	0.12
West	324	7.0	10.0	14.9	0.17	0.27
United States	363	9.8	25.4	7.5	0.40	0.12

Percentages of Total U.S. Averages

North Atlantic	72	70	53	24	217	17
East North Central	95	102	33	65	105	67
West North Central	307	318	34	307	107	308
South Atlantic	67	74	305	95	21	25
South Central	75	70	167	67	21	100
West	89	71	39	199	40	225

South Atlantic and South Central Regions; the former produces three times more than its needs. Some of the deficit regions have commercial broiler areas which partially supply the demand. The relatively low level of commercial broiler production in the East and West North Central Regions has caused much speculation. However, better alternative opportunities in other agricultural enterprises appear to offer the best answer to the question "Why does not the Midwest (East and West North Central Regions) produce more broilers?"

Turkeys show an entirely different pattern of surplus-deficit relationships. The North Atlantic Region, producing less than one fourth of its needs, is the most strongly deficit. The East North Central and South Central regions are also deficit. The South Atlantic Region is only slightly deficit and the West North Central and Western Regions, producing more than twice their needs, are heavily surplus. The movement of turkeys from farms to market, in general, follows these surplus-deficit relationships, with a large share going to cities in the North Atlantic Region.

Duck are clearly deficit in production in the South Atlantic, South Central, and Western Regions. The East and West North Central Regions are only slightly surplus. The North Atlantic Region produces more than two times its needs, and ducks move from this region to all other parts of the United States.

Geese show a surplus-deficit pattern similar to turkeys within the heaviest producing areas in the West North Central and Western Regions. The South Central Region is on balance and the remaining regions are deficit (Table 3).

The Foreign Market

Exports of all egg and poultry products, consisting primarily of eggs in the shell and poultry meat, totaled 34.7 million dollars in 1957. Imports amounted to only 1.4 million dollars, giving a net export balance of 33 million dollars. During recent years exports have substantially exceeded imports (Table 4). Venezuela, Canada, and Mexico have been the principal countries to which eggs and poultry have been exported. However, during 1956 and 1957, Switzerland and West Germany became our best customers for processed chickens. Imports have come mainly from Canada.

The acceptance of United States egg and poultry products in foreign markets is highly variable and depends upon such factors as the foreign governments' restriction on the use of dollars, competition from other countries, varying tariffs and trading agreements, and the efforts of foreign governments to develop their own production.

Table 4. U.S. Exports and Imports of Poultry and Eggs, Quantity and Value, Average 1951-1955, Annual 1956-1957 ⁹³

MARKETING POULTRY PRODUCTS

Commodity	Unit	Quantity			Value		
		Average 1951-55	1956	1957	Average 1951-55	1956	1957
<i>Exports</i>							
Poultry meat:		<i>Thousand</i>			<i>Thousand Dollars</i>		
Chickens and capons, fresh or frozen	pound	* 6,699	24,508	28,472	2,772	7,807	9,105
Other poultry and game, fresh or frozen	pound	* 8,299	17,267	11,162	3,868	7,313	4,386
Canned chicken	pound	2,424	2,765	2,191	984	1,006	733
Eggs:							
In the shell	dozen	41,216	44,721	31,726	17,924	19,246	14,196
Dried	pound	11,730	1,853	1,365	4,811	1,993	1,428
Frozen or otherwise preserved	pound	571	827	604	240	430	310
Live poultry:							
Baby chicks	head	* 14,193	26,588	15,915	2,435	4,811	3,298
Other	pound	* 2,268	3,268	4,525	743	977	1,286
Total		...	...	...	33,777	43,583	34,742
<i>Imports</i>							
Poultry meat:							
Turkeys, fresh, frozen or prepared	pound	1	5	11	†	7	12
Chickens, ducks, etc., including game, fresh, frozen or prepared	pound	60	42	146	36	19	57

Birds, including poultry, prepared or preserved	pound	282	246	295	502	563	708
Eggs:							
In the shell							
Chicken	dozen	4,423	1,571	1,278	2,134	813	495
Other	dozen	148	124	140	96	91	119
Dried, whole, yolks and albumen	pound	216	9	2	295	13	2
Frozen or otherwise prepared	pound	49	6	7	23	8	8
Live poultry:							
Baby chicks	head	110	78	28	14	41	12
Other	pound	938	181	11	293	56	11
Total		...	...	...	3,453	1,611	1,424

* 1932-1935 average. Not shown separately prior to 1932.

† Less than 500.

These efforts to increase foreign production have been meeting with some success: Canada's 1957 production showed a 12 per cent increase over 1956 and Mexico an 8 per cent increase, in comparison with a 1 per cent decrease in United States production. The Netherlands, the world's largest exporter of eggs, and also South Africa, Japan, and the United Kingdom showed substantial increases in production in 1957 over 1956. The total production for 26 reporting nations of the free world for 1957 amounted to only slightly more than twice the United States production for the same year. The heaviest eating countries of Europe consume only about 5 pounds of poultry and 150 eggs per capita per year compared with a per capita annual consumption of about 30 pounds of poultry and 358 eggs, in the United States.

Although foreign markets offer some opportunity for sales, their importance is relatively small when compared with the domestic market. For example, export sales of eggs in the shell, the most important export item, totaled less than 32 million dozen in 1957, whereas United States farm production in that year was more than 5 billion dozen eggs.

Questions

1. Define a specialized farm flock of poultry.
2. How do the products of commercial poultry farms rank as contributors to cash farm income?
3. What trends are evident in the size of flocks on commercial poultry farms?
4. What can be expected as the rate of lay per year produced by layers on poultry farms?
5. Where are the commercial broilers produced in the United States?
6. Give some typical flock sizes for commercial broilers, turkeys, ducks, and geese in the United States, and indicate the areas of concentrated production.
7. How does the location and growth of population affect the production of poultry and poultry products?
8. What measures are being taken to increase the exporting of egg and poultry products?

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Marketing Channels and Activities of Handlers

Marketing functions or services include many phases such as assembling small lots from producers; processing, grading, and packing the products; transporting to distant cities; and distributing relatively small lots to retail stores, hotels, and restaurants. In economic terms the utilities of time, place, and form are added so that acceptable products are offered to the ultimate consumer. The marketing channels through which the products pass are complex and flexible. The term "middlemen" is often used to describe a wide variety of assemblers, processors, and distributors. They are continually seeking lower cost and more satisfactory methods of performing essential marketing functions, because their survival depends upon their ability to compete with one another.

Between the 3.4 million farms producing poultry and eggs and the 173 million consumers, there are approximately 700 large and several thousand small poultry slaughtering plants. In addition there are probably more than 15 thousand assemblers of eggs. Frozen eggs and dried egg solids are prepared in more than 100 plants. The 1954 census of business showed a total of 2,660 merchant wholesale establishments primarily engaged in selling live or dressed poultry, eggs, and related products.

Largely because consumers have demanded more and more marketing services, the marketing margins for most farm products have increased through the years, and costs for performing many services have been increased. In contrast, the marketing margins for poultry and eggs have stabilized or decreased, reflecting outstanding gains in efficiency in the marketing system. As an example of these gains, recent progress in improving the quality of market eggs and the resulting simplification of the grading operation is noted on page 66.

MARKETING ACTIVITIES

Assembling

Since eggs and poultry are generally produced in relatively small amounts, the volume handled is too small and too irregular in quality to avoid frequent sorting and assembling into commercial units. For eggs the collection process begins in gathering from the nests, then continues in accumulating on the farm, concentrating the eggs from many farms at the country stores or buying stations, assembling by the trucklot shippers, and shipping from widely separated shippers to the city receivers.

Grading

During the processes of assembly and distribution, eggs and poultry are graded as the occasion requires. In order to determine the quality and value, they are frequently graded when purchased from the farmer. The most effective grading of eggs can usually be done immediately before the products are delivered to the final retailer and consumer.

During recent years with improved quality of eggs being produced from many flocks and with better candling and handling, many large retailers and other distributors are having the grading done nearer the point of production and still can be reasonably sure of having the desired grade delivered to the consumers. In this way the expense of handling off-grade eggs along with the good ones, in the latter stages of marketing, is eliminated, and in addition the grading costs are usually less outside the city markets.

Packing

Eggs and poultry are packed in especially designed packages for proper transfer of the various qualities and quantities during the processes of marketing.

Transporting

The business of transporting or carrying the products is a chain of operations made up of several links, as from the nests to the farmhouse, the farmhouse to the store or receiving station, then to the shipper, market receiver, jobber, retailer, and finally to the consumer.

Storing

Eggs and poultry are not all produced in the same amounts at all seasons in the quantities demanded by the consumers, and storing from the period of surplus to the period of scarcity is often desirable and is a commercial operation.

An important part of the function of storing is the short holding that is necessary in accumulating the products on the farm, at the country store, or at the packing plant. To avoid temporary gluts and wastes in the market and yet maintain an available supply ready for consumers involves additional holding. The consumers themselves often hold products for a week or more before consumption.

Assuming Risk

Ownership or responsibility for goods always involves some risk. The risk is serious in handling perishable products for which the market price fluctuates. Ownership for even a few minutes may entail a considerable loss due to a change of sentiment among the buyers; or natural conditions may cause the goods to deteriorate enough to result in a serious loss. The risk of credit losses, trade depressions, refusals by buyers, and the like, all make up some of the problems of the middleman and the costs must be covered by his charges.

Financing

The farmer or his financial backer finances the eggs and poultry from the hatching and feeding of the chicks until the grown birds are ready for market or are ready to produce eggs. Because of replacement costs, the farmer is anxious to receive cash when he sells. Distributors usually assume the financing from that time until the eggs are consumed and sometimes for a considerable time afterwards. The need for financing the cost of baby chicks, feed, and sometimes the laying stock, has helped to bring about various forms of integration during recent years. The control of the purchasing and marketing usually goes with the financing.

Buying and Selling

The function of bringing about a transfer of ownership is a distinct and vital part of the marketing program. Most business is organized on a competitive basis in which transfers are made by sales and purchases. Ownership changes occur when title to the goods passes from seller to buyer. A good seller disposes of his goods for as much as he can possibly obtain, and the buyer obtains the quality desired as cheaply as possible. This interplay helps in arriving at a correct price.

Allotting and Distributing

Allotment and distribution constitute a distinct market activity. Certain buyers are able to handle specific qualities and quantities of goods satisfactorily, but any greater quantity of a certain quality at a particular time would overstock them. In the same way, the needs of cities change daily and hourly. Some of the problems in the markets arise from the need to determine the available qualities and quantities of eggs and poultry and then to let each lot flow into that trade which can best handle it.

There is a continuous movement of eggs and poultry between all parts of the country and the world. The seasonal, geographic, and climatic conditions, as well as the changing desires of the producers and consumers, determine the rate and direction of this movement. Marketmen must be skilled in detecting and interpreting such influences.

TYPES OF DISTRIBUTORS

The marketing system has been built up by a continuous search for opportunities for profit by individuals. As changes in demands make adjustments necessary, new opportunities have arisen. Specialization or division of labor is partly the result of natural inclinations of individuals, but mainly the result of necessity, born of competition and fostered by the struggle for survival plus the influence of technology, climate, soil conditions and many other factors.

As the business of marketing eggs and poultry has gradually become more complex, more people have been attracted to this line of work, and many of these people have found it more to their liking or financial benefit to specialize in a particular phase of the field. The specialization that is found in the marketing field may seem to lead to considerable duplication of work, for the functions of buying and selling must be performed every time eggs or poultry are transferred from one specialist to another. Financing, assumption of risk, storing, and similar functions are repeated frequently. However, efficiency is usually assured by the fact that business has been developed on the basis of free competition between all units performing necessary functions.

Each handler can secure his remuneration only by performing some function for which someone is willing to pay him voluntarily. Transfers from the producer to the consumer tend to be at the lowest possible cost for service rendered; this aim is the determinant of the

route to market. Competition prevents ten specialists from handling a truckload of eggs if one person can perform the same function satisfactorily and more cheaply.

MARKETING CHANNELS

Producers and consumers of eggs and poultry are located in virtually every county in the United States. There are about one million establishments helping to move poultry and eggs from producers to consumers (Fig. 3). Each establishment does business in its own special way—each trying to shorten the route by performing a better service at less cost. This marketing system is made even more complex by variations in qualities of eggs and poultry, their perishability, and local supply and demand conditions. The continuous interplay of these factors taking place all over the country creates rapid changes in buying and selling sentiment in the minds of the millions of people involved and results in continuous price fluctuations. The numbers of units participating in the various phases of marketing are constantly changing. Economic changes, most efficient sizes for the various units, services required, and many other factors cause these changes.

Many studies have been made of farmers' sales of eggs and poultry to various types of outlets. The choice of a particular outlet or combination of outlets depends on such things as access of the farm to an outlet; the ability or willingness of producers to produce and market the kind, quality, and volume of product demanded; and the alternative opportunities available to the producers. Many producers find that they make more profit by giving their full attention to the job of producing more and better products and leaving the marketing functions to those who specialize in them.

In producing areas adjacent to large markets, a relatively large proportion of the poultry is shipped directly by the producers to the wholesale receivers in the city. Eggs of high quality frequently pass directly from the producers to the consumers, or to local receivers who sell to retail stores or to route men. The ordinary mixed qualities pass through the normal processes of the wholesale dealer, jobber, and retailer.

Traditionally, poultry flocks have been relatively small in general farming areas. The eggs and live poultry were brought together into economic units by moving through country stores, hucksters, and buying stations toward central assemblers or shippers. At this stage the eggs were graded into wholesale grades and packed loose in 30-

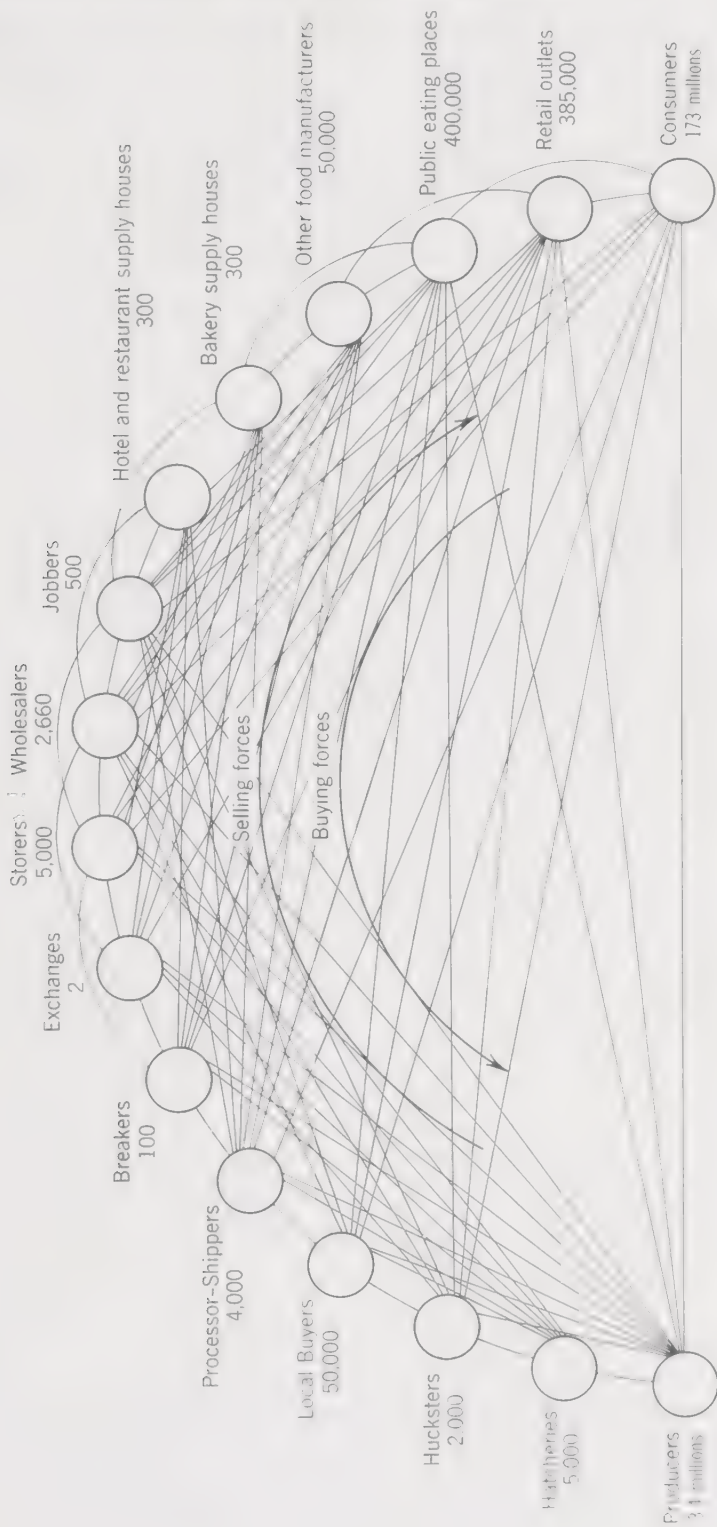


Fig. 3. Poultry and egg marketing channels. The figures shown here are indicative only, as the exact data cannot be definitely ascertained.

dozen cases; poultry was shipped alive or dressed. These products were then shipped in carlots to wholesale receivers in terminal markets where they were sold to jobbers and retail outlets.

With the growth in the size and number of commercial flocks, shorter and more efficient marketing channels have been developed. The growth of supermarkets and mass merchandising is bringing about changes in the marketing channels to meet the requirements of specification buyers of chain stores and other large distributing organizations.

The major marketing channels through which eggs and poultry move vary by sections of the country. Shell eggs destined for table use in the Pacific Coast States move mainly from farmers or ranchers to egg assemblers (frequently cooperatives) that perform grading and cartoning operations and then deliver directly to retail outlets. In the Midwestern States a large portion of the table eggs are picked up by the country assemblers' trucks from farmers, country stores, and buying stations. They are brought into the central assembly plant and graded into wholesale grades and shipped loose in 30-dozen cases in truckload lots of 400 to 600 cases. The shipments move to wholesale receivers who candle and carton the eggs and sell in lots of one or more cases to retail outlets. In the Northeastern States producers frequently grade the table eggs for size; then country assemblers pick them up from the farms and deliver them to city wholesale receivers and jobbers. Here they are candled into consumer grades, cartoned, and delivered in small lots to retail outlets. In the Southern States eggs were traditionally traded for groceries at country stores and rolling stores. More recently, however, substantial quality-control-conscious producers have increased in number, and in many instances the candling and cartoning is done at the farm, after which deliveries are made directly to large retailers.

Live poultry in all parts of the country now moves mainly from farms directly to processing plants, where it is prepared in ready-to-cook form. From there it is shipped in truckload lots to chain store warehouses and wholesale receivers. At this stage it is broken down into smaller lots and distributed to retail outlets.

KINDS OF HANDLERS

Most of the commonly accepted terms describing the handlers or middlemen depend upon the combination of marketing functions they perform. However, there is some local variation in usage depending upon local custom or development of the area into a different produc-

tion and marketing system. In some parts of the United States all of the assembly and distributive marketing functions (described earlier) are performed by single firms. In fact, producers who grade and carton eggs and then sell directly to consumers are performing all of the marketing functions. However, the bulk of the producers and consumers are separated from each other by hundreds of miles, by days of time, and by their divergent interests regarding the kind and quality of product to be handled. The job of distributors in the country or city is to help bridge the gap between producers and consumers. Specialization in the performance of marketing functions has proceeded most rapidly in areas of concentrated production, on one hand, and in areas of concentrated population, on the other hand.

Hucksters

In rural sections of the country, where poultry production is an important industry, hucksters collect eggs and poultry from the farms during the active season. On a day's route they ordinarily collect 20 to 40 cases of eggs or equivalent amounts of live poultry. Eggs make up most of the business during the spring and early summer, whereas poultry gradually increases from summer until about the first of January. Ordinarily poultry is taken directly to the poultry slaughtering plant by the huckster, as most country stores do not like to handle it.

This method of collecting has served a distinct purpose in improving the quality of eggs, as contrasted with the older method of leaving it to the farmer to take his eggs to the country store any time he wished. The personality of the huckster and his influence on his patrons are strong factors in determining the qualities of the eggs which he collects. The huckster must obtain 1 to 2 cents per dozen for his time and expense to make his work pay a living wage.

Country Stores

To a lesser degree now than formerly, some country stores handle eggs. The proper handling of eggs in the country stores is handicapped by the fact that most of the eggs are brought to town on one or two days in the week, Saturday being the most popular. There are so many customers to be waited on at that time that the eggs are generally accepted at fixed prices, without regard to quality. Such case-count buying discourages the production of better eggs. Usually the proprietor tries to make about a cent or more per dozen profit, but frequently he is satisfied to sell the eggs at the same price he paid for them or at a loss, charging his expenses for handling and financing against the grocery trade. In some places the country stores run trucks

or rolling stores into the rural areas to sell groceries and buy eggs, which accomplishes the huckster's job in combination with the grocery business.

Buying Stations

In some parts of the United States the shipper or assembler has buying stations scattered over his supply area. These stations may specialize in purchasing eggs, poultry, cream, and other farm products, and often they offer additional services such as selling and delivering feed and other farmers' supplies. Some country stores act as buying stations for shippers. Many feed dealers, packing plants, and hatcheries service producers by delivering feed and picking up eggs and poultry.

Shipper

It is the shipper's job to connect the area of production with the market. In performing his services, he purchases the eggs and poultry and prepares them for shipment to the particular markets and receivers best satisfying his needs. The feeding and dressing of poultry or shipping live poultry constitutes a function of the egg and poultry shipper.

Central assemblers of eggs. In areas of commercial egg production, central assemblers of eggs operate truck routes, pick up the eggs directly from farmers, grade, pack, and sometimes carton the eggs, and ship in truckload lots to wholesale receivers or large retailers. Grading stations, packing plants, and other terms are used to describe this operation. Egg assemblers are located in every state (Fig. 4).²¹

Poultry slaughtering plants. In areas of commercial production, specialized poultry slaughtering plants are now the principal handlers through which poultry passes. They receive in truckload lots, slaughter the birds, usually prepare them "ready-to-cook," and ship in truckload lots to wholesale receivers and chain store warehouses.

Brokers

A brokerage business in the egg and dressed-poultry trade has been developed in response to a distinct need. Brokers assist the shippers in disposing of their goods in markets with which they are unfamiliar and help buyers who wish to purchase a considerable quantity but do not know from whom the desired quality and quantity may be obtained. The need for brokers, except for "futures" trading on exchanges, is fast disappearing as quality brands become better known and direct connections are made between country shippers and city distributors.



Fig. 4. Commercial egg assemblers, revised to January 1958. Each dot represents a firm that receives eggs from farmers and handles 400 cases or more per week from all sources. (U.S.D.A., AMS.)

Receivers

Wholesale receivers, located in the large markets, consist of two types, commission merchants and wholesale dealers. Commission merchants operate strictly on a commission basis and are rapidly declining in number, largely because the inflexibility of their operations prevents skillful meeting of competition. Wholesale dealers buy the goods and then sell them, taking a chance on making a reasonable margin of profit on the deal. The function of the receivers is to receive the products from the shippers in large lots and sell them to the jobbers and retail outlets in smaller or selected lots.

Receivers must keep in touch with conditions all over the country, solicit shippers, and look after inspection for transportation damage in order to repack if necessary. They also usually assume the costs of financing the goods and of credit risk. Some packers and shippers, acting as receivers, have branch sales facilities in large terminal markets.

Jobbers

It is the jobber's business to supply the retailer's needs, and since there are so many types of customers his business is varied and fre-

quently expensive to maintain. Among his special items of expense are the following: investment (including accounts receivable), stock on hand, real estate, equipment, costs of operation (including labor and losses in candling), grading and packing eggs for the retail trade, packages, personal solicitation of customers, deliveries, accounting, and advertising. Jobbers usually own their buildings, as their business is comparatively permanent, is dependent on good will, and is a line of trade requiring years to establish. The two functions of receiving and jobbing are frequently combined.

Storers

The function of storing is sometimes performed by the shipper and sometimes by the receiver or jobber. The incentive encouraging shippers to store is usually a desire to take a risk with a corresponding chance of profit or the necessity of taking goods off the market to avoid an immediate loss. The incentive encouraging jobbers to store is usually the necessity of having a certain grade of goods available during the fall and winter. The receiver who stores usually does so purely as a speculative venture. There are also speculators, not otherwise engaged in handling eggs, who make use of storing as a purely speculative venture.

Packer Branch Houses

National organizations such as the meat packers maintain sales branch houses in many cities. They receive meat and meat products, dairy products, and poultry products in straight or mixed carlots or trucklots from their country packing plants. They offer a full line of these products to small independent retailers, hotels, and restaurants.

Hotel-supply Houses

The hotel-supply house may be a department of a jobbing house, or it may be independent. It caters to the hotel, steamship, and restaurant trade and carries only the qualities desired by these particular customers. Among the most popular products are eggs, egg products, squabs, broilers, roasters, fowls, turkeys, ducks, capons, and game. Sometimes the hotel wishes to order a thousand or more squabs of the same size for a banquet; such an order as this on short notice requires special facilities for proper handling, possessed only by the hotel-supply house. These houses usually maintain more elaborate facilities for handling their business than is necessary for the jobbers. Orders are often made up in fancy packages for delivery to the customers. The hotel-supply houses often extend credit and in general cater to the specialized demands of institutional outlets.

The term ship chandlers is sometimes used to describe specialized houses that cater to the needs of steamships.

Retailers

The retailer is the final link in the marketing chain. Independent grocery stores, specialized dairy stores and butcher shops, route men, chain stores, and supermarkets are important consumer outlets for eggs and poultry. National and regional chain store and supermarket organizations ordinarily maintain warehouses that service their stores in the respective areas. These warehouses receive carlots or trucklots of poultry and eggs from processors and shippers. In some of them egg candling and cartoning departments are maintained.

INTEGRATION OF MARKETING ACTIVITIES

The growth of marketing integration in recent years has focused considerable attention on the subject. The two basic types are vertical integration and horizontal integration, although, in most instances, in practice the two forms are more or less mixed according to the particular needs or desires of those concerned in the operation.

In marketing, vertical integration occurs when a single firm owns and operates, for example, a processing plant, a wholesale warehouse, and retail stores. Horizontal integration occurs when a single firm owns and operates, for example, many packing plants. A limited number of examples of both types have been in existence for many years in poultry and egg marketing.

In the production and marketing of commercial broilers, vertical integration has proceeded rapidly in certain areas. For example, a single firm may own and operate a hatchery, feed company, and slaughtering plant. The firm offers contracts to the hatchery supply flock owners and to the producers who grow the broilers. A recent publication summarizes many studies of these contractual arrangements.⁴

The trend toward specialization in table-egg production and caged layers has offered an opportunity for vertical integration in this field. A wide variety of plans or contracts has been offered producers.

A significant experiment in integration for egg production was observed by one of the authors in early 1960 in Mississippi. Here a large feed company supplies baby chicks from selected hybrid strains, employs grower specialists to rear them to laying age, then places them with selected farmers within the area. The company supplies all feed and other such needs and furnishes field men (one for each 100,000 layers) with facilities for health diagnoses and the like. The farmer,

who also cares for the layers and eggs, delivers the product to the central plant as prescribed by the company. The company then markets the product under its advertised brand. The farmer does his part for an agreed payment per month per 1,000 layers. This plan, in one trial, has developed to a size of about 270,000 layers cared for by about 50 to 60 farmers. An efficient size of approximately 500,000 layers is contemplated for this unit.

Much can and has been said about the advantages and disadvantages of integration. From an economic point of view, the growth and survival of integration as an institution will depend on its ability to offer a cost combination of performing production and marketing functions that is lower than alternative systems. From a social point of view, the popularity of integration will depend on the willingness of producers and others to give up the right to make production and marketing decisions in exchange for guaranteed prices or income.

Farm Cooperative Marketing Organizations

As the growth and activities of farmer cooperatives have expanded in recent years, many of these have become outstanding examples of integration, usually of the vertical type. Cooperatives are discussed in Chapter 15.

CREDIT

Agencies, such as Dun and Bradstreet, Incorporated, make it their business to obtain financial statements and all available data concerning the standings of business concerns throughout the country. These data are accumulated, and the results are published in a credit book to which business concerns and others subscribe. Special reports are made on request, for a nominal charge.

Almost every large organization has its own credit man who checks all available information and then determines the wise line of credit to be extended to the firm's customers. It is his business to see that the accounts receivable are kept at a minimum without unduly interfering with good sales operations. In many cities the business men, sometimes in commodity groups, combine to form an effective credit agency.

EXCHANGES

Egg and butter exchanges are in operation in Chicago and New York City. These exchanges provide a floor on which trading both for



Fig. 5. On the Chicago Mercantile Exchange, offers and bids are recorded on black board. The New York Mercantile Exchange operates similarly. (Courtesy Chicago Mercantile Exchange.)

“spot” and “future” deliveries take place, they furnish facilities for arbitration between members, and they receive market reports and information on all important market influences.

The blackboard method of recording offerings and bids is used (Fig. 5). On “spot” sales the exchanges require that goods sold be delivered within a few hours. On “future” sales the times when deliveries are required are designated as a term of the contract, as, for example, Septembers, Octobers, Decembers.

The exchanges undertake to maintain a high standard for dependability in the business done by their members and to expel promptly any members not living up to their principles. The exchanges help small dealers to obtain some of the benefits of large business, such as market news, contact with market conditions, and opportunity for buying and selling on an open free market basis.

INFORMATIONAL FACILITIES

Good trading requires quick, constant, and intelligent communications. Telephone, telegraph, and radio are used for distributing all kinds of business information, such as market conditions, financial and political news, and quick contacts between branches of the same organization.

Information bearing on the production, quality, and wastage of the product, transportation facilities, consumption demands, prices of substitutes, and prospects of strikes is readily available in trade and general periodicals and newspapers. Governmental departments, including the U.S.D.A. Market News Service and the Agricultural Estimates Division, furnish daily, weekly, and monthly statistical data pertaining to prices, production, storage holdings and receipts in the principal markets, weather conditions, and shipping. Such reports are mailed to all who request them.

Production estimates are based on such evidence as census reports, crop reports, reports by country shippers, relative quantity of poultry slaughtered and shipped from the rural districts which is not left for egg production, receipts in the markets, and opinions of farmers and others.

TRADE ASSOCIATIONS

Men in all lines of endeavor find that certain things can be accomplished better by working together. Bitter though their daily competition may be, advantages are frequently to be gained by coming at times to some common ground and talking things over. In such purposes we have the prime motive for most of the trade associations, conferences, and conventions. The work of such groups is a part of the general struggle for existence but yet embodies a sense of cooperation which business men are finding essential to success.

These trade associations do not engage primarily in promotional and advertising activities but deal with such legislative and business problems as may affect the respective memberships. Organizations more directly concerned with promotions and advertising are discussed beginning on page 247.

Associated Poultry and Egg Industries

Major poultry organizations of producers, processors, distributors, and service groups have joined together under this title for such action as the common interests may dictate from time to time. Each organization has one delegate on the board which operates on a rule of unanimity. This organization is active only on major national problems affecting producer, processor, or distributing interests.

Institute of American Poultry Industries

This is a national organization of poultry and egg processors and dealers. Organized in 1927, the Institute has pursued a program

designed to encourage the production of better quality poultry and eggs and to improve the quality of product delivered to the consumers. The Institute sponsors practical research. It works with processors throughout the country to encourage more farm service work, quality buying programs, and greater procurement and processing efficiency. The Institute holds an annual Fact Finding Conference and exhibition of new equipment at which valuable facts are developed on processor problems and broad industry matters. It publishes a weekly letter which is sent to all of its members.

National Council of Farmer Cooperatives

This is a national body comprised of cooperative marketing and purchasing associations controlling more than 75 per cent of all cooperatively handled farm products and supplies in the United States. The Council keeps close watch on legislative and other national problems affecting farmers' cooperatives.

National Poultry, Butter and Egg Association

This association, incorporated in 1906, is one of the oldest serving the poultry, butter, and egg trade. The standing committees include the following: membership, transportation, law and legislation, publicity, arbitration, dressed poultry, live poultry, butter, egg, cheese, and tariff. The National holds an annual convention which has come to be a popular meeting place for shippers, receivers, and other allied interests.

National Poultry Producers Federation

This group is a federated body of representatives from each of the major poultry producer organizations in the United States. Eight organizations make up the federation. One representative from each of the producer groups is a member of the federation board. The federation works on a rule of unanimity and specializes in legislative and other governmental matters.

Northeastern Poultry Producers Council (NEPPCO)

This Council was founded in May 1931 to work for the general welfare of all phases of the poultry industry in the 13 Northeastern States from Maine to Virginia. This organization represents producers, breeders, hatcherymen, turkey growers, broiler growers, duck growers, cooperative egg and poultry marketing organizations, and allied industries. The official voting body is composed of four delegates from each state. NEPPCO has divisions for hatcherymen, cooperative mar-

keting agencies, and turkey growers. One representative from each state poultry association plus one representative from each division make up the board of directors.

Pacific Dairy and Poultry Association

This is a good example of a regional group of distributors, processors, and handlers organized for promoting the common interests of those located in a particular area. In this instance it comprises 11 states—California, Oregon, Washington, Idaho, Montana, Wyoming, Utah, Colorado, Nevada, Arizona, and New Mexico. Organized in 1924, the association has done notable work covering such matters as freight rates, icing charges, various transit privileges, import tariffs on poultry and dairy products, grading regulations and general legislative problems.

State and Regional Associations

The poultry, butter, and egg dealers in several of the important egg-producing states have state members. In some instances regions having common problems have set up associations to look after the special interests of that area. Among the more active of these groups are: Delmarva Poultry Industry, Incorporated, Minnesota Poultry, Butter and Egg Association, North Central States Institute, Western Poultry Congress, and Southeastern Poultry and Egg Association. One of the functions performed by some of the state associations is the holding of conventions which provide opportunities for buyers from the important markets to meet and discuss business with the local state shippers. State legislative problems also are considered by these local groups.

Other Associations

Among other associations with interests in the egg and poultry field that are not particularly concerned with promotions and advertising are the American Farm Bureau Federation, American Poultry Association, American Poultry and Hatchery Federation, American Poultry Historical Society, National Egg Products Association, Inc., National Grange, Poultry Breeders of America, Poultry Science Association, and World's Poultry Science Association.

Most of these associations publish valuable bulletins or reports useful for reference. The American Poultry Association publishes a standard for judging poultry for exhibition; The Poultry Science Association publishes a valuable scientific journal called *Poultry Science*. The World's Poultry Science Association publishes the *World's Poultry*

Science Journal, issued quarterly, and holds a World's Poultry Congress every four years; the egg-producing nations of the world bid strongly for the honor of being host to this congress.

Questions

1. What is the function of the "middleman"; are they increasing or decreasing in number, and why?
2. What is the function of egg receivers?
3. Give examples of vertical integration in the egg business; in the broiler business.
4. What do the egg exchanges in Chicago and New York City provide?
5. What informational facilities are available in your home area in regard to market conditions?
6. List some of the trade associations in the egg and poultry business and discuss one association in detail.

Demand for Eggs and Poultry

Eggs and poultry are produced and marketed in units that are relatively small in size and comparatively inexpensive in cost. They are purchased and used extensively by people in every economic and social class and are generally considered to have a very wide consumer acceptance. Almost everyone eats chicken, eggs, turkey, and duck occasionally, and a great many people make one or more of these products a regular part of their daily diet.

The consumption of eggs and poultry is both increased and decreased by the actions of a relatively large percentage of the individuals who make up the total population. Because of this, the agencies and interests, working toward the objective of increasing poultry products demand, usually channel their promotional activity through sources that reach the greatest possible number of individuals.

A knowledge of the basic principles and characteristics of demand will help one to obtain a better understanding of the economic reasoning behind certain actions intended to influence people in favor of using more poultry products. Thus, the following is a brief, general description of demand with some special definitions and descriptive material that places emphasis on the demand factors most closely related to the marketing of poultry products.

Demand

Demand is a desire (a wish, want, or longing) to possess a product or to obtain a service or its benefits.

Active demand. Demand becomes active, and results in the procurement of a product or the receiving of a service when the value of the product or service is within the means of the person or persons desiring it and is wanted by them more than any other product or service of the same, or less cost.

Total demand. The combined active demand of individuals equals the total active demand for a specific product or service. Thus, total active demand determines the quantity of a product or service that will be used by a given population under specific conditions of price and time.

Supply and Demand

Perhaps the most universally understood economic law is the Law of Supply and Demand. It is generally interpreted to be a law stating that when the supply of a product or service is low in relation to the demand, the price will be high, and when the opposite condition exists the price will be low.

This interpretation is correct and applies to most cases. In some instances, however, elasticity and other factors will influence the extent of the increase or decrease in price with a change in supply. Thus, a more complete knowledge of the characteristics and limitations of demand is required to more fully understand its impact on the economics of marketing activity.

The demand approach. The egg and poultry industry's over-all products promotional organization, the Poultry and Egg National Board is, for example, working mainly on the demand side of the poultry industry. It is attempting to do the things that encourage people to want more egg and poultry products, which will cause them to either purchase more at the same price or be willing to pay more than they otherwise would have to get the quantity and quality of product they want.

The supply approach. The other major way in which the consumption of eggs and poultry can be increased is by providing the product at a lower price because both supply and demand can contribute to a change in the amount of product purchased and consumed. For example, in 1946 the people of the United States consumed approximately 293 million commercial broilers at an average wholesale price of approximately 32.7 cents per pound. In 1957, they consumed over a billion and a quarter broilers at an average wholesale price of 18.9 cents per pound. It is, at best, difficult to determine whether this change was the result of increased demand, or if this demand already existed and needed only the lower price and the greater supply to increase consumption.

Either the supply or demand factor operating independently can effect a quantity change. In many cases, a change is the result of the

action of only one of these factors. But, it is sometimes difficult to determine accurately whether supply, demand, or a combination of both factors is responsible for the change.

Some characteristics of demand. Demand is generally a slow changing factor. Increased consumption of a product or service is sometimes erroneously attributed to increased demand, when the real reason for the increase is on the supply side. When the supply of goods or services is provided at a lower price, and greater quantities are taken, the demand for that additional quantity may have existed for a long time awaiting the supply and the lower price. On the other hand, some increased demand may have attributed to the additional consumption.

Another characteristic of demand is elasticity, which is concerned with the ratio of change in quantity taken in response to a change in price. When the price of salt is increased or decreased, the quantity used by the individual varies only slightly, or not at all. This product is considered to have an inelastic demand. Luxury-type items, like chicken breasts, tend to be more elastic than chicken backs and wings because the consumer can substitute cheaper chicken parts for breasts and still have chicken, but she cannot make cheaper substitutions for backs and wings and still serve chicken meat. Between the extremes of elasticity and inelasticity is a third classification known as unit elasticity, which is represented by a product that responds quite uniformly in quantity taken over a wide price range. For example, when the price is extremely high a certain quantity of the product will be taken, and as the price decreases, there will be an almost premeasurable steady increase in the quantity of product purchased.

Some limitations of demand. Although egg and poultry products have utility, or value to a very large part of the total population, the demand for them is not an unlimited one. It is controlled by certain restrictions imposed by basic economic laws that apply to these products, as well as to many others.

Each person has his own individual active demand schedule for eggs and poultry. It has become established by his economic means, his personal likes or dislikes for the products, his appraisal of its value as related to substitute or alternative foods, and other contributory factors. The following example shows an individual's current demand schedule for poultry and eggs. The figures were arbitrarily selected to illustrate the quantity-price relationships for pounds of chicken or dozens of eggs. This example could apply to a housewife, whose demand schedule reflects her family desires and needs, or to an individual concerned only with products for personal use.

<i>Possible Price</i>	<i>Pounds of Chicken or Dozens of Eggs Demanded</i>
\$1.00	0
.80	1
.60	2
.40	3
.30	5
.20	10

When a housewife enters a store, the pounds of poultry or the dozens of eggs she will buy will probably be the amount that corresponds most closely to her demand schedule. If, under these circumstances and at this particular time, she finds the price of eggs is 40 cents per dozen, she will take three dozen. If they are 80 cents, she will take only one dozen. Should the price be \$1.00 per dozen, she will forego these products and will probably substitute another food item for which she has a greater demand.

If, just prior to this period, this particular housewife may have especially enjoyed a meal of one or both of these products, or if she had recently read an attractive article about them, it may have influenced her in favor of paying more, purchasing a larger quantity, or both. On the other hand, if she had recently had an unsatisfactory experience with eggs or poultry, her demand schedule may have reflected a lower price, a more limited quantity demand, or a combination of the two. If the housewife has recently read an advertisement stating that substitute food items, such as pork chops or cereals, are being offered at prices which in her opinion are lower or a better value than the eggs and poultry, she will purchase the pork chops, cereals, or other foods instead of the eggs or poultry. If suitable substitute articles in her opinion are not worth as much as eggs and poultry, she will then purchase the quantity of eggs and poultry that her demand schedule indicates in relation to quantity and price.

The Law of Diminishing Utility in the Marketing of Eggs and Poultry

The Law of Diminishing Utility, which is concerned with the decreasing value that people place on successive units of the same item, applies directly to the consumption of eggs and poultry. The practical application of this law may be illustrated in the following manner: a dozen eggs may have considerable utility for a housewife as a means of improving the quality of her pastries and satisfying the desires of her family for breakfast eggs. However, there are certain limitations

which will prevent that housewife, and many others like her, from purchasing almost unlimited quantities of eggs for the purposes described above. It is the natural law known as the Law of Diminishing Utility.

In illustrating diminishing utility, we arbitrarily assign twelve points to the highest degree of satisfaction that can be obtained from possession, or use of a dozen eggs as shown in Table 5.

In Table 5 the individual's demand for the first dozen eggs is at 12, the maximum desire for that product, but the total demand for 6 dozens is not 6 times 12 but only 42. The first dozen gave the individual maximum utility, or a satisfaction value of 12. The second dozen gave slightly less utility, and with each successive dozen, the utility diminished until the value, or demand completely ended with the sixth dozen.

It must be clearly understood that this applies only to a specific time and place. At another time, or under different conditions, the individual may place a different utility value or demand for these eggs and would, therefore, want a greater or smaller quantity, depending upon whether the demand was increased or reduced.

Marginal utility in the marketing of eggs and poultry. Marginal utility is closely related to the law of supply and demand. It is the amount that the total value or utility of a group of the same kind of products would be decreased if one or more units were removed. For example, in the diminishing utility table (Table 5), the removal of the sixth and seventh dozens would reduce the utility value of the total by only 2. Consequently, we assume that the marginal utility of the sixth dozen is 2 and the last, or seventh dozen, under existing conditions at the time in question, has no utility value to the particular

Table 5. Operation of Law of Diminishing Utility as It Applies to the Individual's Demand for Eggs

Number of Dozens	Total Utility	Utility of Last Dozen
1	12	12
2	22	10
3	30	8
4	36	6
5	40	4
6	42	2
7	42	0

individual involved. Under these conditions, it would be difficult to increase consumption of eggs unless this individual (and the great number of other individuals she represents) could be influenced to the point at which she felt the need for more eggs to improve her cooking, to increase the health of her family, to economize on her food budget, or for other similar reasons.

Market price in the wholesale egg trade is greatly influenced by the principle of marginal utility. This fact is shown clearly when, for example, a market's major supply of eggs is suddenly reduced by some unusual circumstance, such as weather or labor problems in the producing area, and a large quantity of product is no longer available to buyers. A regular egg buyer, who had no previous knowledge of the fact that supplies in his market were going to be reduced, may have been thinking in terms of a market price of around 35 cents per dozen. This was, in his opinion, the utility value of the last units in that market, which are the units largely responsible for the current market price. When this buyer arrived in the market and learned of the reduced volume condition, he would recognize the fact that the last units, which were responsible for the relatively low 35 cent price, no longer existed and that, to obtain his eggs, he would have to move up the price scale where the marginal utility, as reflected by price, was higher.

The student must recognize that the practical day-to-day volume buyers of eggs and poultry have little or no concern for technical economic terms, such as diminishing returns and marginal utility. However, in their daily activity, they follow an operating procedure that continuously puts these laws and principles into practice. They are able to do this because of their trading experience. The application of this experience shows their knowledge of the "how" side of poultry products marketing operations. Those who know how to operate best are often the most commercially successful. The economist explains why these daily trading operations tend to follow certain economic patterns. He does this by using technical economic terms which are the defined, specific, and all-inclusive words required by him to explain the "why" side of these marketing operations.

Questions

1. Discuss two major ways by which the consumption of eggs and poultry can be increased.
2. Indicate some examples of elastic and inelastic demand as they apply to eggs and poultry.

3. Give some examples of the quantity-price relationship as the consumer may apply the principle in purchasing eggs.
4. How may recently read or heard advertisements affect the consumption of poultry meat?
5. How may the marginal utility of eggs be influenced by disruption of transportation?

Supplementary Reading

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PLATE I

1. Canded appearance of an egg of U. S. Quality AA.



2. Canded appearance of an egg of U. S. Quality A.



3. Canded appearance of an egg of U. S. Quality B.



4. Canded appearance of an egg of U. S. Quality C.



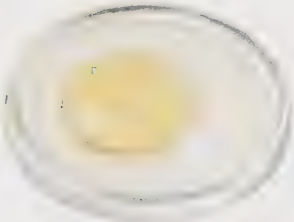
A, [15], (6)



B, [30], (9)



C, [40], (12)



D, [45], (13)



E, [50], (15)



F, [60], (17)



G, [75], (20)



H, [90], (23)



I, [105], (24)

5. Surface yolk colors as used for standards in scientific studies. (The number in brackets is the corresponding standard in the Sharp scale,* and the number in parentheses is the corresponding standard in the color rotor scale.)

* P. F. Sharp, Cornell University, Ithaca, N. Y.

† Developed at the State College of Washington, Pullman, Wash.



1.



2.



3.



4.

- 1. Opened egg of U. S. Quality AA.
- 2. Opened egg of U. S. Quality A.
- 3. Opened egg of U. S. Quality B.
- 4. Opened egg of U. S. Quality C.

The Egg

The egg of the domestic fowl contains all the essentials necessary for the development of a chick embryo. Eggs rank with milk as a general source of essential food elements for growth and maintenance of health in the human body.

The structure of the egg is complex, and an understanding of the component parts is desirable for the development of good methods of marketing by which the delicate food qualities may be retained.

STRUCTURE AND COMPOSITION

The principal parts of the egg are the yolk, albumen, shell membrane, and shell, as shown in Fig. 6. The candled ° and broken-out appearance of eggs is shown in Plates I and II between pages 42 and 43.

Yolk

The yolk consists of yolk material, latebra, germinal disc, and vitelline membrane. The yolk material is high in fat content. The latebra is a channel that connects the germinal disc to the center of the yolk. Its function is unknown but is probably involved in the development of the embryo. The germinal disc is composed of cells, and it is here the embryo begins growth in a fertilized egg. The vitelline membrane encloses the yolk; it is thin, strong, and almost colorless. The yolk is approximately 31 per cent of the total weight of the egg.

The yolk may be light or dark yellow, according to the feed and the individual characteristics of the hen. The yolk of the fresh egg, as it is first opened on a flat surface, lies in a relatively rounded form. It normally is three times as broad as it is deep, and the vitelline

° The term candling is the common term applied in the industry and in this text to denote holding the egg before a light to observe the nature of the shell and contents. The term originated years ago when candles were actually used for the lighting. In those days eggs were considered as "candled" when smoke from the candle could be detected on the shells.

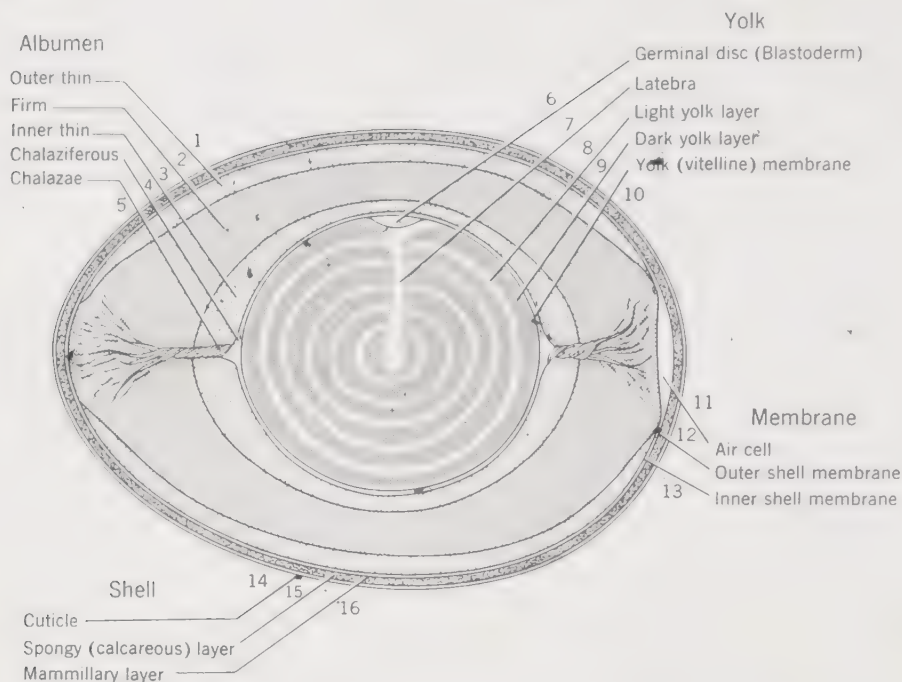


Fig. 6. The parts of an egg. Modern methods of feeding tend to eliminate the clear markings of light and dark yolk layers long considered as distinctive features noticeable in hard-boiled eggs. (U.S.D.A., PMA.)

membrane should not rupture readily although it may be slightly wrinkled (Plate II, 1 and 2). Normally, the yolk is about in the center of the egg and has a specific gravity slightly less than that of the albumen. For this reason, the yolk of an unopened egg lying still for many days at a temperature of 60° F, or above, will rise and stick to the inside of the shell.

The germinal disc appears as a small light colored spot on the surface of the yolk. In a new-laid fertile egg, this spot is about $\frac{1}{8}$ inch in diameter, because some development of the embryo takes place before the egg leaves the body of the hen. The disc is usually smaller and more irregular in shape in an infertile egg. By holding an egg in a horizontal position for several seconds, then cracking it on the underside and dropping the contents straight down, the germinal disc is usually visible because the yolk normally rotates so that the disc is on its upper side.

As an egg ages, the yolk tends to absorb water from the albumen and as a result the yolk becomes larger. The vitelline membrane becomes weak as the egg ages, making it more susceptible to breaking.

Yolks of this type assume a more flattened shape when the egg is broken out.

Albumen

The albumen consists of the chalaziferous layer, inner thin layer, firm or gel-like layer, and outer thin layer. The albumen is high in water and protein content, is tinted a faint greenish yellow and is nearly odorless. The albumen is approximately 58 per cent of the weight of the egg.

Chalaziferous layer. This is a very firm but very thin layer of albumen and it makes up about 3 per cent of the total albumen. It immediately surrounds the yolk and is continuous with the chalazas (pronounced Kah-lay'-záz). The chalazas branch out on opposite sides of the yolk and extend into the firm layer of albumen. The chalazas look like twisted, whitish, opalescent cords. Normally the chalaza at the large end of the egg has a clockwise twist, and that at the small end has a counterclockwise twist. The chalazas are said by R. C. Baker at Cornell University to contain relatively large amounts of lysozyme, which is both a protein and an antibiotic that destroys many bacteria by breaking down their cell walls. This breakdown helps to keep eggs from deteriorating while being marketed. The chalazas also act as anchors to prevent the yolk from rising rapidly toward the shell when the egg is at rest.

Inner thin layer. This layer surrounds the chalaziferous layer and comprises about 21 per cent of the albumen.

Firm layer. This layer provides an envelope which holds the inner thin and chalaziferous layers of albumen and the yolk. It sometimes adheres to the shell membrane at each end of the egg and comprises about 55 per cent of the albumen.

Outer thin layer. This layer lies just inside the shell membranes except where the firm layer is attached to the shell. It comprises about 21 per cent of the albumen.

The height of the albumen of an opened egg has been accepted as a dependable measure of egg quality (Fig. 7). Much research work on market egg quality has centered around efforts to correlate various candling characteristics with the height of the albumen as well as the percentages of thick and thin albumen.

HAUGH UNITS. One of the more precise measures of interior quality is the method developed by R. R. Haugh.³² Haugh units are the albumen height adjusted according to the weight of the egg. A high Haugh unit value means high quality. On the Haugh unit scale U.S. AA quality eggs measure above 79 Haugh units. "A" quality

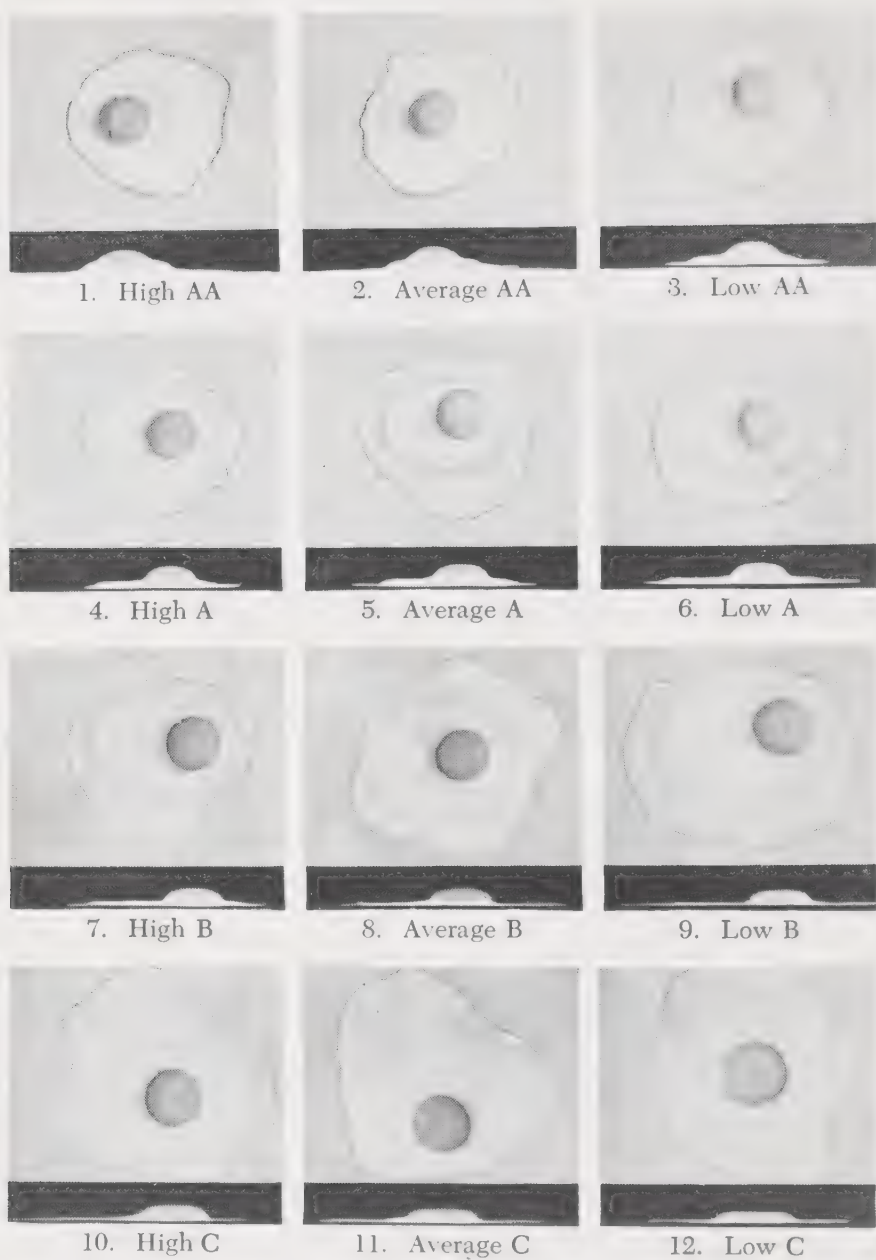


Fig. 7. Interior quality of eggs (recommended standards for scoring the quality of broken-out eggs). The pictures on this chart show the interior quality of eggs as evidenced by top and respective side views of eggs opened on flat glass plates. The reference to quality grades under each egg indicates the specifications of the U.S. Standards for Quality of Individual Shell Eggs with respect to albumen and yolk quality, met by that respective egg. Quality factors dealing with the shell, air cell, and defects are not included. For purposes of scoring for contests or records, scores 1, 2, and 3 might present the appearance of broken-out eggs of high, average, and low AA Quality; 4, 5, and 6 represent high, average, and low A Quality; 7, 8, and 9, high, average, and low B Quality; 10, 11, and 12, high, average, and low C Quality. (U.S.D.A.)

measures 55 to 78, B quality measures 31 to 54, and C quality is less than 31.

Shell Membranes

The inner and outer shell membranes consist of an unorganized network of organic fibers slightly impregnated with mineral salts. The two membranes line the inside of the shell. The inner of these two membranes (Fig. 6) is often referred to as the egg membrane. The outer one is next to the shell and adheres more or less closely to it. The outer shell membrane is generally about three times as thick as the inner one. The two membranes give some protection to the contents of the egg from outside sources of contamination but are not impervious either to gases or to microorganisms. In some eggs the shell membranes are slightly pink in color and slightly darken the candled appearance of the egg.

Air cell. As the egg leaves the body of the hen the contents completely fill the shell. As soon as the egg starts to cool, the contents contract and a space filled with air drawn in through the porous shell is formed between the two shell membranes. This space, called the air cell, is usually formed at the large end of the egg, as the shell is generally more porous in this area. However, it may be at some other point, depending on where the membranes separate most readily. When the egg has just cooled, this space is quite small. The air cell increases progressively in size as the contents of the egg decrease in volume through evaporation.

Shell

The shell is a calcareous deposit placed around the outer shell membrane in the uterus of the hen. It is about $\frac{1}{70}$ inch thick in normal strong-shelled eggs, and it is approximately 11 per cent of the total weight of the egg. The shell color is believed to arise from certain derivatives of the hemoglobin, and as far as is known, is not affected by the feed, except for temporary results from some medicinal drugs.

The main body of the shell consists of four major parts:⁸⁰ the mamillary layer, the spongy layer, the cuticle, and the pores (Fig. 8). The cuticle is the outer covering of the shell. It is believed that eggs keep better if this covering is not removed, although careful study indicates that the loss of the cuticle does not necessarily impair the keeping quality of the egg, provided that infection or other detrimental conditions are avoided. Washing does not ordinarily remove the cuticle whereas use of an abrasive such as sand or emery is likely to do so.

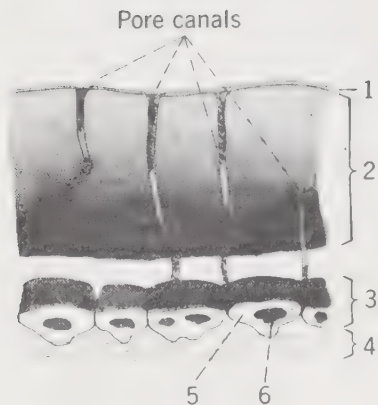


Fig. 8. Magnified cross section of shell of an egg. 1, cuticle; 2, spongy layer; 3, mammillary layer; 4, shell membrane; 5, mammilla (mammillary knob); 6, protein matrix material forming core of the mammilla. (U.S.D.A., PMA.)

Mottled shells are said to indicate old eggs, but this belief has been disproved.² It has been shown that most mottling is due to an uneven distribution of moisture and that nearly all the mottling may be eliminated by keeping eggs under proper humidity conditions (Fig. 9).

Other work shows that the so-called glassy shelled eggs, which are thin and have a metallic sound when clicked together, are not as porous as normal shells and, therefore, do not permit as rapid evaporation of contents.

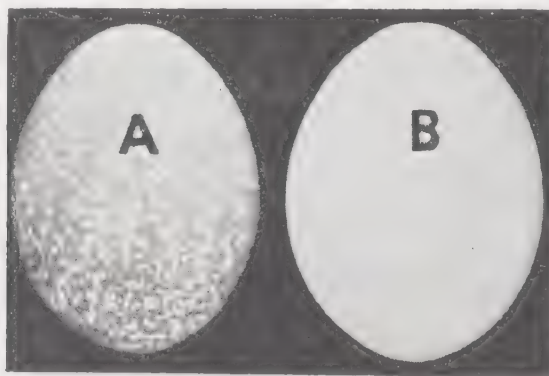


Fig. 9. Change in candling appearance of the shell caused by changes of humidity.² A, Mottled shell; B, same shell after drying.

Composition of the Egg

The average chicken egg weighs about 2 ounces or 24 ounces to the dozen. The chemical composition is shown in Table 6.

Albumen. The protein of the egg contains all of the necessary amino acids in well-balanced proportions. The thick albumen is com-

Table 6. Chemical Composition of the Hen's Egg *

		Water	Protein	Fat	Ash
<i>Per cent</i>					
Whole egg	100.0	65.5	11.8	11.0	11.7
Albumen	58.0	80.0	11.0	0.2	0.8
Yolk	31.0	48.0	17.5	32.5	2.0
		Calcium Carbonate	Magnesium Carbonate	Calcium Phosphate	Organic Matter
<i>Per cent</i>					
Shell	11.0	94.0	1.0	1.0	4.0

* The egg (not including shell) is a good source of proteins, vitamins, and minerals.

posed mainly of the proteins ovomucin, ovoalbumen, conalbumen, ovoglobulin, and ovomucoid. Ovomucin is responsible for the gel-like nature of the firm albumen. The albumen contains some water-soluble B vitamins, especially riboflavin which gives the greenish yellow tint to the albumen.

The thin albumen is composed mostly of the same kind of proteins as in the thick albumen except that its content of ovomucin is lower.

Yolk. The most important yolk proteins are ovovitellin and livetin. The first of these comprises approximately three-fourths of the yolk protein. The fatty substances are mostly glycerides, lecithin, and cholesterol.

Yolk pigments (mostly xanthophyll) come from the yellow corn and green plant materials that the hens eat. The yolk contains almost all of the vitamins except vitamin C. The vitelline membrane is mostly proteins similar to those of the shell membranes. The yolk contains iron, sulphur, copper, phosphorus, potassium, sodium, magnesium, chlorine, calcium, and manganese.

INTERIOR QUALITY

An egg starts to deteriorate in interior quality as soon as it is laid. Contributing to this quality loss are temperature, humidity, enzymic action, and hydrogen-ion concentration.

The term "fresh" is used in this book to mean an egg of good quality,

equal to U.S. AA or A quality. New-laid eggs are usually but not necessarily fresh eggs within this definition.

When a normal, fresh, white-shell egg is candled, the entire contents appear pinkish yellow, but by looking closely one can see the air space at the large end and the diffused shadow of the yolk near the center. The yolk appears suspended in the center of the albumen; its deeper color fades gradually into the normal tone of the albumen. The shell membranes are firm around the air space.²

In the high quality new-laid egg the yolk casts a very dim shadow and whirls rapidly with the albumen. With the ordinary candling light one is likely to be deceived and think the yolk is not whirling, because it is held so firmly in the center of the egg by the albumen that its motion may not be readily discernible. With a small aperture candling light this motion may be clearly seen. As the yolk moves, there is usually an indistinct dark spot with an accompanying light spot following it. This light spot is the outer end of one of the chalazas, which may extend close to the shell; the light spot is caused by a reflection of light from the inside of the shell that shines around the white cord which, itself, casts the shadow. The chalazas are often mistaken for meat spots, but meat spots are darker and have no light in them.

Brown-shell eggs at the candling light display a reddish brown color, which varies in tint and intensity according to the pigment of the shell. White eggs, lacking shell pigment, permit the yolk and other details of the contents to be observed more clearly.

INTERNAL CONDITIONS INFLUENCING QUALITY

The quality of an egg may be influenced by a number of internal conditions. These are usually considered as abnormalities and a knowledge of their characteristics and origin is worthwhile in developing an ability to recognize and appraise their importance.

Inheritance

The results of research work have shown conclusively that certain interior and shell qualities are inherited. Size, shape, and color have long been known to be affected by heredity.³

Thick and thin albumen. The amount and new-laid condition of the firm albumen have been established as inherited characteristics by several laboratories.^{43, 44, 45, 50, 51, 105} Both inheritance and handling of the eggs after they are laid are causes of high percentages of thin albumen.

Mottled and blemished yolks. The yolk surface of some eggs have mottlings, which appear to be transparent patches and are sometimes called water blisters. The underlying causes of this condition seem heritable. Research work has indicated that they may be caused by the inroad of water from the albumen when the latter is abnormally thin. Apparently this osmosis may occur before the egg is laid or whenever the causative conditions develop.

Off-flavor. Among the peculiarities of eggs produced by individual hens is off-flavor. A "fishy" flavor sometimes encountered may be a characteristic of individual hens, since others in the same flock have been found to produce normal eggs.¹⁰⁶

Blood spots. Studies by numerous workers have shown that the incidence of blood spots is heritable. Candling eggs to identify those containing blood spots has been found to be only 50 per cent efficient in either brown or white eggs. Recently electronic devices have been developed to detect blood spots.

Shell quality. Egg shell quality can be improved by appropriate breeding methods. Research workers have shown that egg-weight loss, porosity, and shell strength may be influenced and improved through breeding.⁸⁵

Keeping quality. There have been reports of individual hen and family differences in keeping quality of the eggs produced.⁴² Much work remains to be done on this problem.

General Physical Condition and Feed

The physical condition of the bird apparently has an effect on the quality of the egg. Several reports⁵² show that an outbreak of avian pneumoencephalitis (Newcastle disease) affects subsequent egg quality, resulting in lowered albumen quality, poor shells, and abnormal air cells (air present in the eggs was in small free-floating air bubbles). Other respiratory diseases have similar effects. Certain drugs that are successfully used for disease prevention or cure may have effects on egg quality such as shell and yolk changes. Sulfanilamide in the ration of the laying hen thins the egg shell,⁷² and treatments for fungus used on seed grains have been found to cause stoppage of laying.

Eggs produced during the summer and after an intensive season of laying seem to have a more watery albumen than those produced during the spring. Watery eggs are of lower quality and therefore undesirable for cold storage or long holding. When such eggs are candled, the yolks seem to float nearer the shell than in better-quality eggs.

Apparently there is some improvement in shell and albumen quality after a period of molt. Eggs produced during the pullet year evi-

dently have a shell and albumen quality superior to the eggs produced by the same birds in the second year. This superiority is one of the apparent advantages of the all-pullet flock.

Onions, and sometimes rape, turnips, and cabbage, when fed in too large amounts have been said to affect the odor and flavor of eggs. There is little reliable information on off-flavors that may be caused by feeds.

Calcium, preferably in carbonate form, phosphorus, and manganese must be present in the ration at adequate levels to produce sound shells, and vitamin D is necessary for the utilization of calcium and phosphorus by the hen for shell formation.³⁴ Both the diet and sunlight are sources of vitamin D. It is said also that if the incidence of blood and meat spots is high and the flock is turned on green range, the frequency of occurrence is sometimes greatly reduced.

A number of workers have reported that the feeding of cottonseed meal to chickens causes an abnormal yolk color after the eggs are stored for a few months.⁷⁵ The material in cottonseed meal causing yolk discoloration is gossypol. Since very small amounts will cause trouble, it is impossible so far to produce a cottonseed meal that is safe for diets of laying hens.⁴⁹

Pink whites are sometimes found in "cottonseed" eggs. It is believed that this condition is caused by a second factor in cottonseed, which has not yet been identified. Most of the yolk color is due to xanthophylls and in a lesser degree to a carotin-like pigment. These are complicated chemical combinations needing much further study.⁵⁶ Excessive consumption of yellow corn or green feed when the hens are first allowed access to it in the spring always darkens the yolk. It is rather common knowledge that fresh, green feed produces a much deeper yolk color than an equivalent amount of dried greens.

Olive-colored yolks (Grass Eggs). Occasionally, eggs are observed with olive-colored yolks. There has been a popular belief that if hens consume excess quantities of green grass the yolks become olive-colored, and consequently such eggs have become known as grass eggs. The name is a misnomer, however, since several research workers have shown definitely that olive-colored yolks are not caused by grass, and the real cause is yet unknown.

Ovarian Conditions

Double-yolk eggs. Eggs with two yolks are very common and can usually be detected by the appearance of two distinct yolk shadows before the candling light. These eggs are as good as any single-yolk eggs but are usually oversize, and to keep the salable product uniform

they are ordinarily separated from the others. According to research reports ¹⁶ 65 per cent of double-yolk eggs result from the simultaneous development and ovulation of two ova. Another 25 per cent result from the simultaneous ovulation of two ova that have developed in normal sequence, one of which would normally be ovulated a day later. The remaining 10 per cent may result either from the successive development and simultaneous release of two ova, one of which should have been released a day earlier, or from an ovum remaining in the body for a day after ovulation and picked up by the oviduct along with the ovum released on the succeeding day. Triple-yolk eggs, apparently formed in a similar way, are not unusual.

Multigerminial discs. Many yolks have more than one germinal disc, showing as round, light spots on the surface of the yolk. Usually only one of these discs develops when the egg is incubated.

Misplaced yolks. Sometimes yolks are dropped outside the oviduct into the body cavity. They are usually absorbed by the body tissues, but it is thought that they sometimes return to the oviduct and are surrounded by normal egg components. This may account for the occurrence of eggs in which the yolk is partially hardened and appears baked.

Blood spots and bloody eggs. Perhaps the most common of the faults arising in the ovary are blood spots, frequently called blood clots (Fig. 10). Bloody eggs are less common. For many years it has been thought that both these conditions were caused by the rupture of a blood vessel in the ovary of the hen at the time when the mature yolk was released from its sac. Although bleeding may occur at the time of ovulation, it happens so rarely and is so insignificant in amount that it cannot be called a common cause of blood spots in eggs.⁵⁴

The cause of bloody whites (bloody eggs) is less clear. It is possible that, in eggs in which blood diffuses throughout the thick and the thin white, the blood comes from the dissolution of a blood clot. Blood spots have been said to be caused by fright, by high perches, by high rate of egg production, or by a deficiency of vitamin K. Research has failed to prove any of these as causes but has clearly shown the heritable nature of the condition.

When the egg is candled, a blood spot appears as a bright red spot or streak and can usually be distinguished, if it is $\frac{1}{16}$ inch or more in any dimension and if the egg is well twirled. A blood spot is distinguished from other spots by its bright red color and by the fact that it is frequently on the surface of the yolk and moves with the yolk. The bloody egg has a red tint throughout, sometimes differing little from the general color of a brown-shelled egg before the candle.



Fig. 10. Types of blood and meat spots. First row (left): 1, blood clot—red; 2, transitional—brown; 3, meat spot—pinkish tan; 4, meat spot—dark center, white rim; 5, meat spot—white. Second row (center): 6, blood clot (dark) and meat spot (white) on the same yolk; 7, 8, 9, blood streaks; 10, blood clot and blood streak. Third row (right): 11, blood streak; 12, two pedicular clots (not attached to the yolk) of medium size; 13, blood sheet; 14, combination of blood clot, blood sheet, and blood streak; 15, blood streak. (Illinois Agr. Exp. Sta.) ⁶⁰

These defects are important in marketing, because the presence of even small amounts of blood in eggs may cause consumers to stop using eggs, at least temporarily, until they recover from the adverse psychological reaction.

Oviduct Conditions

Meat Spots. A “meat spot” is defined as any solid foreign substance found between the vitelline and shell membranes of the egg

(Fig. 10). These spots may be found floating in the white, either entirely free or attached to the chalazas. They are dark red, liver-like, brownish red, or deep brown. Some are white or white with small brown specks. A few are light red.^{*} Some meat spots are thought to result from the transformation of blood spots under the influence of changes in the pH[°] and high environmental temperatures, either before ovulation or during egg formation, or even after the egg is laid. There is at present no satisfactory explanation for the cause of all meat spots. The meat spot is often confused in candling with dense chalazas or a blood spot. The shadow of a meat spot is darker than that of the chalazas and is not accompanied by a spot of refracted light; it also tends to be duller and more opaque than the blood spot.

Soft-shell and thin-shell eggs. Eggs with soft or thin shells or having no shells at all are sometimes produced. A soft-shell egg is one that has been laid prematurely or before the secretion of the shell material is completed in the uterus. It appears probable that such eggs are caused by the shell gland failing to function properly or the egg mass slipping through the shell-forming area too rapidly. There is considerable evidence that shell thickness is basically an inherited factor. Even if a bird carries favorable heritable characteristics, deficient rations and respiratory diseases are two common causes of thin-shell eggs.

Thin and porous shells allow very rapid evaporation and permit an easy entrance for invading bacteria. Whenever eggs with such shells are detected in candling, they should be separated from normal ones, because they are likely to become checked or broken and they will not withstand long holding.

Glassy eggs. These eggs which resist evaporation, are usually characteristic of individual hens. The cause other than possibly heredity is unknown. Such eggs are ordinarily suitable for marketing with other eggs.

Body checks. Some eggs become checked or cracked while the shell is being formed; more lime is then deposited over the crack, virtually resealing the egg. Such eggs are termed body checks or sealed checks. These checks in the shell are invisible, except for lines or slight ridges, unless the eggs are candled. The shells are weakened, and they are likely to break and smear other eggs during shipment. This type of checked egg is sometimes designated as blind check, but the term "body check" is better, as marketmen commonly understand blind checks to be slightly cracked eggs in which the crack is not easily discernible.

^{*} A chemical term indicating the degree of alkalinity or acidity.

Bacterial infection. The oviduct of the hen is usually free of bacteria and new-laid eggs from healthy hens seldom contain any organisms. The albumen is not a favorable medium for bacteria and thus provides further protection from infection.

Foreign substances within eggs. Grains or other foreign substances may be forced up the oviduct from the cloaca, or, if an egg has previously been broken in the oviduct, the broken contents may gradually harden and cling to the oviduct walls. Such substances become included with the albumen when an egg is being formed and are found in the finished product. In this way rings of hardened yolk and albumen are sometimes included in eggs.

Eggs within eggs. When an egg has passed through the oviduct and is ready to be laid, some abnormal conditions may cause a reverse peristaltic action which may force the egg back up the oviduct until normal forces again push it along its regular course. In this way, one yolk may be enveloped within two complete sets of albumen, shell membranes, and shell; in fact, three sets have been known to be formed over a single yolk. Sometimes other yolks are met by the ascending egg, and the whole is surrounded by another set of albumen, shell membranes, and shell. The fact that the first egg is usually an abnormally small one may account for the reversal of the peristaltic forces.

Abnormal shapes. If the yolks passing through the oviduct are too far apart to be enclosed as one egg, but yet within an inch or two of each other, they may become connected and form various sorts of dumbbell shapes. Many other abnormal shapes of eggs may be traced to variations in the peristaltic action of the oviduct muscles that affect the rate of production or motion of the egg, or to the shape of the oviduct walls, foreign matter, condition of the glands, and so on.

EXTERNAL CONDITIONS INFLUENCING QUALITY

A comprehension of the factors involved in the deterioration of market eggs is necessary for the proper handling of eggs (Fig. 11).

Temperature

The most important single factor affecting deterioration of quality in eggs is temperature. Low temperature aids in the retention of quality. High temperature is unfavorable.

Lower than incubation temperature. Eggs should be cooled as soon as possible after they are laid to slow the rate of deterioration. Heat

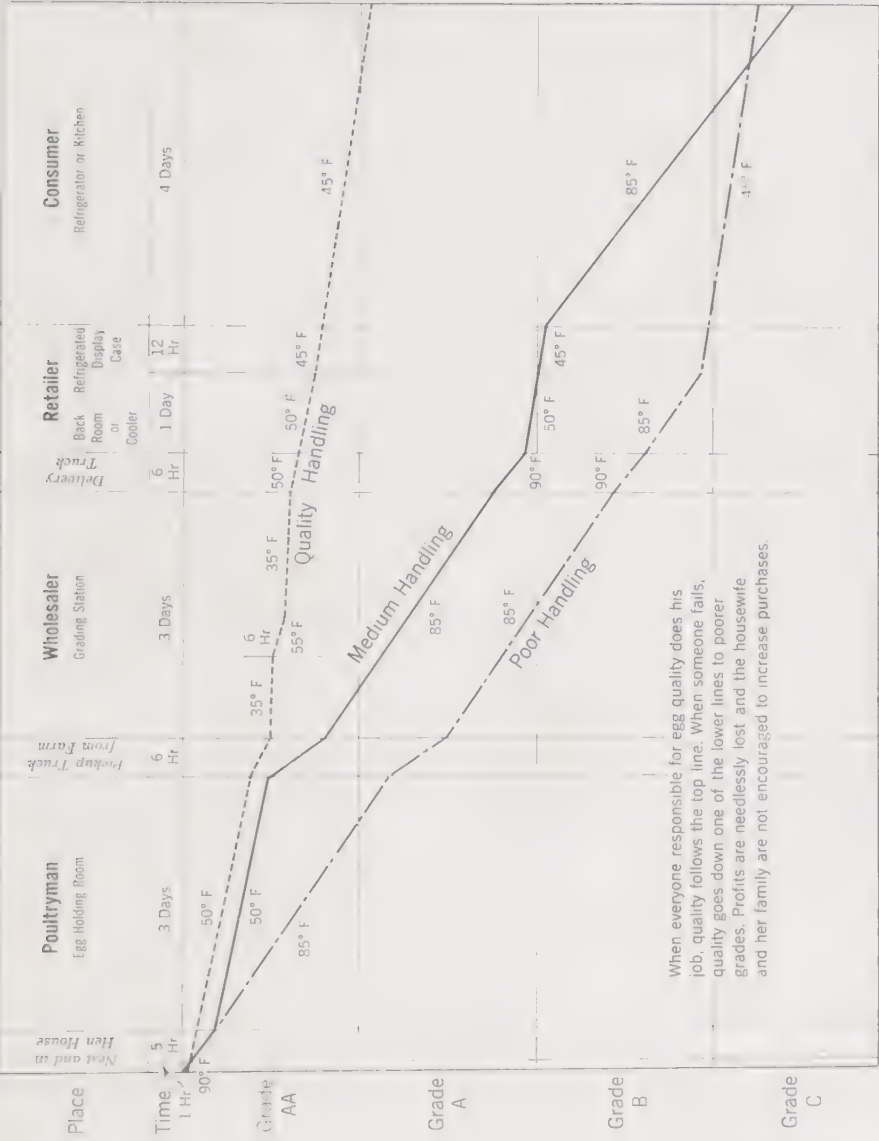


Fig. 11. Quality life of three lots of new-laid AA grade eggs during hot weather. Diagram shows probable changes in egg quality under various conditions likely to prevail during movement from producer to consumer. (Courtesy Ralston Purina Co., St. Louis, Mo.)

also creates more favorable growth conditions for some bacteria that may gain access to the egg.

High temperature is especially disastrous to the quality of a fertile egg. At 85° F the development of the embryo proceeds at a relatively rapid rate.²³ At this temperature infertile eggs also deteriorate rapidly so keeping the eggs cool is even more important than having them infertile.

The effect of heat on eggs and the consequent economic loss have been shown by a number of research workers. One report⁷⁴ shows that temperature is more important than age in egg-quality deterioration. Eggs of the same known interior quality reached the same degree of yolk flatness when held at:

<i>Temperature</i> (Degrees)	<i>Number of days</i>
98.6	3
77.0	8
60.8	23
44.6	65
37.6	100

Another report shows that reducing the egg temperature to at least 60° F as soon as possible after the eggs are laid will help to prevent shrinkage and the lowering of quality.¹⁰⁷ In a trial involving 4 cases of eggs with room temperatures of 58° F and 70° F for periods of 4 and 7 days before shipment, the following results were obtained:

7 days at 70° F – graded 20% Specials (AA)
7 days at 58° F – graded 68% Specials (AA)
4 days at 70° F – graded 74% Specials (AA)
4 days at 58° F – graded 95% Specials (AA)

When the egg is first laid it has the same temperature as that of the hen's body, which is about 107° F. Important to the problem of rapid cooling is a test in which eggs were held in ordinary pails, in wire pails, in perforated pails, and in a wire tray⁶ (Fig. 12). Compared with the ordinary tight-sided pail, the wire-bottomed tray cooled eggs 2.2 times as fast, the wire pail 1.6 times, and the perforated pail 1.4 times.

Thick albumen is converted to thin albumen very slowly at temperatures of 30° to 50° F, but quite rapidly at temperatures of 80° and 100° F.²² For the short-time holding period (10 days maximum) on the farm, eggs should be held at a temperature approximating 45° F and at a maximum of 65° F.



Fig. 12. Trays used for gathering eggs. Here the operator is setting the carrier, after cooling, into a washing and sanitizing machine, before drying and packing. (Courtesy Kuhl Poultry Equipment Co., Flemington, N. J.)

HEAT SPOT. Summer temperature conditions sometimes cause the quality defect termed heat spots. Such spots may develop to a point at which they can be seen in candling. In fertile eggs the development of the embryo may have started, but no blood has yet appeared. A reddened spot appears on the yolk when candled. The spot is usually round and $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, but all variations of size, shape, and density of color may occur. When the egg is opened the affected area of the yolk usually seems transparent, a condition brought about by the movement of water from the white into the yolk.

Incubation temperature. A recent ruling by the U.S. Food and Drug Administration declares that all eggs which have been incubated shall

be regarded as adulterated and may not be disposed of unless denatured to prevent their diversion to human food channels.^{21a}

Every hour during which an egg is held at incubation temperature (95° to 110° F) seriously affects its quality. If the egg is fertile and has a white shell, the candler can ascertain with fair accuracy after only 10 hours of incubation that the egg has been incubated. He can detect a tiny embryo on the upper surface of the yolk, and the yolk floats closer to the shell than in the fresh egg. When the egg is broken open it will be noted that the yolk appears a little darker and that an indefinite ring is beginning to form around the germinal disk.

After 20 hours of incubation, the embryo is clearly discernible through the shell when candled. The yolk usually floats closer to the shell than before. When the egg is opened, two or three rings around the germinal disk are usually distinguishable. The yolk has a heated appearance: it is darker in color and more flattened. If the incubation heat continues for 5 days or longer, and the embryo lives, the blood vessels become clearly visible to the candler.

DEAD GERM. If for any reason the embryo dies during the period of its growth, a blood ring is formed by the settling of the blood in the outer boundary of the network of blood vessels. In eggs in which the blood ring is so indefinite as to be ordinarily indiscernible at the candle, its presence may be detected by a crescentic shadow on the shell just below the yolk. An egg containing a dead germ cannot be sold for human consumption, but may have value for nonfood uses.

INFERTILE EGG. When an egg is infertile, some of the difficulty in handling is avoided. When candled after 5 days of incubation heat the yolk is slightly darkened, the air cell is enlarged and the whole egg displays the characteristic orange-red appearance of a heated egg. Such an egg when opened is distinguished by a very watery albumen and a weak vitelline membrane, and the chalazas, having merged with the dense layer of albumen, may hardly be visible. The egg may be suitable for certain food uses even after being subjected to incubation temperatures for 2 weeks or so, but it cannot be legally disposed of without being denatured.

High temperature—baked or boiled eggs. The egg white begins to coagulate at about 140° F.⁶⁸ Such a temperature is often reached under exposure to the summer sun, in egg receptacles set close to a stove, or in overheated egg washing machines. Eggs affected by such temperatures are essentially the same as boiled eggs and, like them, may be detected in candling by their opaque, solidified appear-

ance or by strings of coagulated albumen if the cooking was not completed. Experiments have been successfully conducted using relatively high temperatures as a means of preserving the interior quality of shell eggs as well as for the pasteurizing effect on the shell surface (thermostabilization).

Freezing. Eggs freeze at about 28° F. Freezing usually causes a gummy consistency of the yolk, but the structure of the white is not much affected. Because of the expansion of the water in the egg, the shell usually cracks unless the egg contains a large air cell due to evaporation. While the egg is still frozen, the frosty feeling of the shell is sometimes the best indicator. When it is candled, the contents of an egg that has been frozen and then thawed appear loose around the air cell, sometimes even frothy if the egg is twirled vigorously. The yolk shadow is usually darkened.

Changes of temperature. If cold eggs are exposed to a warm, damp atmosphere, moisture condenses on them. This "sweating" of the eggs is favorable to the development of bacteria and molds which cause mustiness or development of off-flavors. If the eggs are warmed gradually, instead of suddenly, or if the warming is done in a very dry room, "sweating" is avoided. When lined cases containing eggs are kept at a low temperature, moisture will be condensed on the inside of the liner walls, and favorable conditions for mold development are also created. The term "tempering" is commonly used to describe the gradual warming of eggs.

Humidity

The effect of atmospheric humidity on eggs is dependent on the accompanying temperature.

Evaporation. After an egg has been cooled, the further development of the air cell is due to evaporation. Warm air causes more rapid evaporation than cold air. At any given temperature, the amount of evaporation will be decreased by increasing the moisture in the air. Various degrees of evaporation are often used as a partial guide for grading eggs on the markets (Fig. 13).

High humidity in the egg-holding room is desirable to prevent loss of moisture which causes increased air cell size. If temperatures are below 50° F a relative humidity of 60 per cent appears satisfactory. With a temperature of 50° to 60° F, the humidity should be about 70 per cent. At a temperature of 60° to 70° F, the humidity should be about 80 per cent. A low temperature is probably more important than high humidity. Recent research work has indicated that neither size nor condition of air cell is as dependable a factor in judging

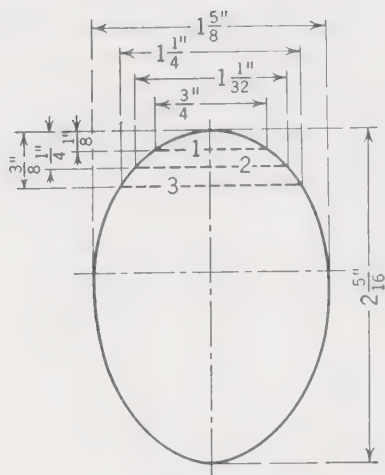


Fig. 13. Diagram showing sizes of air cells found in various qualities of eggs. 1, U.S. Quality AA; 2, U.S. Quality A; 3, U.S. Quality B. Note that for grading standards the depth rather than the width of the air cell is considered. The outline shown here indicates the normal shape and size of egg determined from the average of several thousand typical White Leghorn eggs.

interior quality before the candling light as was formerly believed.

Molds and mustiness. The factors responsible for the development of molds on eggs are moisture, warmth, air, food material, and lack of ventilation. Mold will rarely start unless there is moisture on the surface of the egg, such as is caused by slight sweating, a broken shell, or contact with damp material; but after mold has started it may obtain enough moisture and air from the inside of the egg to continue growth. This development often occurs around the air cell or along checks in the shell, where both air and moisture are available. If the yolk adheres to the shell, molds frequently occur at this point. When the shell is opened, the mold growth found adhering to the inner shell membrane appears like lumps of dense albumen.

Eggs that have become moldy retain the pungent odor and unpalatable flavor of the mold and may impart these flavors to surrounding eggs. All such eggs are unfit for food. Great care is exercised in bakeries and egg-breaking plants to be sure that the person opening the eggs can detect the odor of mustiness, a faculty which some persons do not possess.

Bacterial Infection

In order to lessen the danger of bacterial infection, the egg should be kept clean, dry on the surface, and sound by careful handling.

Rots. The development of bacteria within an egg usually causes some kind of rot. All rots are unfit for food purposes.

The "white rot," often termed "sour" or "addled" egg, is sometimes an early stage of bacterial decomposition. To the candler, an egg in this condition usually appears to be very watery, and by close inspec-

tion one can detect the homogeneous nature of the egg contents in contrast with the normal appearance of the yolk shadow in the albumen. When the egg is twirled before the candle, mixed dark and light streaks cross the line of vision and show distinctly that the egg is addled, or completely mixed. When the egg is opened, the contents are usually light yellow in color, very watery and mixed, and the yolk may be partially solidified. The egg may have a sour odor although frequently there will be no odor.

Eggs containing *pseudomonas* (fluorescent bacteria), commonly known as green rots, are similar to white rots except, at the light, a slightly greenish tint pervades the whole content. Such eggs are difficult to detect unless ultraviolet rays are used.

A crusted yolk is sometimes observed before the candle as a definite opaque area or areas on the yolk. When the egg is broken out, such areas show a flaky, crusted condition. Such an egg sometimes has a sour, acrid odor, and the albumen usually shows a definite yellowish discoloration in the region of the crust.

Rough Handling

Rough handling of eggs is sure to cause some downgrading in market quality even if the shells are not broken. The firmness of the yolk and white is not affected, but there will be many tremulous or broken air cells.

Tremulous and broken air cells. If the air cell is enlarged by evaporation, rough handling will cause the two membranes to split apart beyond the edges of the cell. This splitting, which allows the air cell to move slightly as the egg is turned to one side or the other, gives rise to the term tremulous air cell. If an egg with a loose air cell is very roughly handled, the inner shell membrane may be ruptured. Bubbles may form in the egg white adjacent to the air cell, or the air may float freely in the egg. Such eggs are not necessarily bad eggs; they merely show results of evaporation and rough handling.

Age

Age of egg alone has little meaning so far as quality is concerned. Poor quality may be encountered in new-laid eggs. Also under proper handling and storage an egg may retain a great deal of its "freshness" though it is several months of "age."

Storage eggs. In former years the use of modern cold-storage warehouses has saved enormous losses in the egg crop. Fine quality April eggs placed in a modern warehouse were sometimes better than the

average "fresh" eggs being received on some markets during the summer months.

Storage of eggs is decreasing in volume because production on farms is becoming less seasonal. The essential factors for storage are: (1) low temperature, around 30° F; (2) proper humidity; (3) some air movement; (4) good quality clean eggs to start; and (5) clean sanitary storage conditions.

EXTERIOR QUALITY

When the qualities of eggs for market needs are considered, as is being done continually by marketmen during their buying and selling, the interior and exterior qualities are ordinarily given about equal importance. However, consumer demands are often such that in the springtime, when nearly all eggs are of good interior quality, greater emphasis is placed on size, cleanliness, and general appearance.

Factors Affecting Size, Color and Shape

The three characteristics, size, color, and shape of eggs, are inherited.⁵ By selecting the eggs for hatching, one can closely determine the type of egg to be produced by the offspring. Since there are several other factors in addition to inheritance that influence egg weight, more complicated breeding methods than the mere selection of eggs for hatching must be used to assure improvement and maintenance of this weight character.

Size. Eggs vary in size usually from about 1¼ to 2½ ounces each or from 15 to 30 ounces per dozen. The large majority of eggs weigh 22 to 26 ounces per dozen and average about 24 ounces per dozen or 2 ounces per egg.

Color. Certain breeds of fowl lay only white eggs, others lay brown or tinted eggs, and still others lay blue eggs. There appears to be a distinct seasonal or periodical variation in color intensity.³¹ The intensity of pigmentation decreases from the time laying starts in the fall until early summer, when there is usually a slight increase until the end of the year.

Shape. All sorts of variations from the normal shape are found in the eggs gathered during a single day. Abnormal conditions, such as growths developing in the oviduct or immediate area, may cause eggs to be off-shaped. The grade of an egg is not affected by the shape, unless it is extremely abnormal. Slight bulges in the shell, ordinary creases, moderate wrinkles or roughness, though defects, are not suffi-

cient to exclude eggs from their normal grade. Eggs of extremely abnormal shapes do not fit the standard fillers and consequently present a poor appearance and are likely to be broken (Fig. 14).

Soundness

Broken eggs are designated as “checks” and “leakers.” “Checks” are slightly cracked eggs, the contents not leaking. “Dents” and “cracks” are other terms often used for such eggs. Slightly checked eggs are hard to detect except by candling or by clicking two eggs together. A checked shell provides entrance for bacteria and often leads to excessive evaporation, stuck yolks, mold spots, and rots.

“Leakers” are those eggs from which the contents are leaking. Such eggs are a total loss, unless they can be broken out and frozen or dried, or used by bakeries and the like, in the liquid condition.

Absorption of Odors and Flavors

Eggs will absorb some odors and flavors. Care must be taken to avoid such odors as those of certain fruits—oranges, quinces, or apples—or filth, mold disinfectants, or decaying vegetables. These odors and flavors usually persist in cooking and are sometimes intensified by heating, which renders them decidedly offensive.

Cleanliness

Every year many millions of dollars are lost to the poultry industry because of dirty or improperly cleaned eggs. Although observations have indicated that more than 99 per cent of all eggs are clean before they come into contact with the nest, it has been estimated that dirty and soiled eggs represent a substantial proportion of all eggs marketed



Fig. 14. Variation in the size and shape of eggs gathered in one day. 1. egg weighing $2\frac{1}{2}$ ounces; 2, egg weighing $1\frac{15}{16}$ ounces; 3. egg weighing $1\frac{3}{4}$ ounces; 4. egg weighing $1\frac{1}{2}$ ounces; 5, this egg is so small and narrow that it would tip crosswise in the filler if shipped; 6, this egg is so long that it would be mashed during shipment; 7, a very wide egg. (Courtesy N. Y. State College of Agriculture.)

in the United States. Not only are dirty eggs unattractive in appearance, but also their interior quality is frequently impaired by bacterial infection and by absorption of odors and flavors from the dirt.⁴¹ In spite of all the protection afforded by the various characteristics of the shell and the shell membranes, bacteria of various types found in mud, droppings, wet litter, or grass, can gain access to the interior of the egg in the presence of moisture. (For discussion of cleaning eggs, see page 263.)

Questions

1. Give all the details in answer to this question: how do you candle an egg correctly?
2. How do the contents of a normal, A grade, white-shelled egg appear when candled?
3. How do the contents of a normal, A grade, brown-shelled egg appear when candled?
4. What may affect the color of the yolk of an egg?
5. How can the general physical condition of the flock either past or present have an effect on the quality of the eggs produced?
6. Grade and candle a case of eggs. If possible secure a random sample from a flock. What per cent are cracked, body checks, blood spots, bloody eggs, meat spots, and of abnormal shape?
7. Grade some good new-laid eggs and select some Grade AA, some Grade A and some Grade B. Place a portion under refrigeration and hold the rest at room temperature. Describe what changes have taken place in each group one week later.
8. Describe procedures which can be taken at the farm to improve egg quality.
9. Visit at least two retail establishments and describe the methods used for holding eggs prior to sale to consumers.

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Grading and Packing Shell Eggs

ESSENTIALS OF GRADING

Grading is a classification of the eggs according to characteristics that have an economic value. The characteristics of interior and exterior quality of eggs have been described in the previous chapter. The relative importance of these quality factors varies with the end uses made of the product. In general, the quality factors are grouped as follows:

- I. Interior quality
 - a. Condition of the yolk
 - b. Condition of the albumen
 - c. Size and condition of the air cell
- II. Exterior quality
 - a. Soundness of the shell
 - b. Cleanliness
 - c. Size
 - d. Shape and Texture
 - e. Color

The principle embraced in most grading rules is that, in order to meet the requirements of a grade, the lot being graded must contain a certain percentage of eggs of designated quality with specific tolerances for lower qualities than those specified. Such a plan is ordinarily more workable than a requirement that all eggs in the lot meet the same specific standard. In describing the grade of a dozen, case, or truckload of eggs, it is necessary to mention the several qualities included in the lot, unless one can use a grade term so broad in its description as to cover all of the qualities found therein.

Recently, however, the trend to fewer and larger flocks and attention to better bred laying stock, better housing and feeding practices, and better handling of eggs has been evident. These improved methods of operating have made it possible to grade a larger proportion of market eggs with less tolerance for diverse qualities.

EVOLUTION OF GRADING PRACTICES

Many of the prevailing grading standards are indicated by brand names or trade marks. Certain brands or marks command premium prices because buyers know they can depend on purchasing a product of a definite and dependable quality. The firms packing eggs under such brands usually do a conscientious job of grading, so that the confidence of the buyers will be maintained.

For many years the principal grades in use in the large markets have been those set up by the trade and based on the type of eggs coming to that particular market. On the large markets these grades have been designed for trading on the exchanges and for trading between dealers on different markets. The terms used in many of the cities were similar, but owing to conditions peculiar to each city or section, the interpretation and application of the grades have varied considerably.

Uniformity in grades and grade interpretation have become increasingly important as eggs have moved more freely over state lines and about the country. Consumer grades have also come in more general use as a result of the enactment of laws by a number of states requiring eggs to be sold at retail on a graded basis.

Toward the end of World War I, the U.S. Navy called on the U.S. Department of Agriculture to furnish inspection for eggs delivered to naval vessels. In order to furnish this service, standards for quality and grade were set up. To meet these and other needs, various states and the federal government established grading standards for general use. In some states egg grading is compulsory or virtually so, but the use of the grading standards of the U.S. Department of Agriculture is voluntary. United States grades were widely used during World War II for purchasing by government agencies. Many distributors are now using the grades in packaging eggs for retail trade.

United States standards and grades. Grading standards are changed from time to time so as to keep abreast of the changing trade needs and consumer preferences. However, a brief description of the current United States standards for individual eggs is given here to serve for reference.

The United States standards of quality for individual shell eggs provide the basis for wholesale and consumer grades as well as grades for Armed Forces purchases (Table 7). They have been quite generally adopted by members of industry and by state governments as a

Table 7. Summary of United States Standards for Quality of Individual Shell Eggs ⁶³

(Standards effective December 1, 1946; amended March 1, 1955)

Specifications for Each Quality Factor

Quality Factor	AA Quality	A Quality	B Quality	C Quality
Shell	Clean Unbroken Practically normal	Clean Unbroken Practically normal	Clean to very slightly stained Unbroken May be slightly abnormal	Clean to moderately stained Unbroken May be abnormal
Air Cell	$\frac{1}{8}$ inch or less in depth Practically regular	$\frac{2}{8}$ inch or less in depth Practically regular	$\frac{3}{8}$ inch or less in depth May be free but not bubbly	May be over $\frac{3}{8}$ inch in depth May be free or bubbly
White	Clear Firm	Clear May be reasonably firm	Clear May be slightly weak	May be weak and watery Small blood clots or spots may be present *
Yolk	Well centered Outline slightly defined Free from defects	May be fairly well centered Outline may be fairly well defined Practically free from defects	May be off center Outline may be well defined May be slightly enlarged and flattened May show definite but not serious defects	May be off center Outline may be plainly visible May be enlarged and flattened May show clearly visible germ development, but no blood May show other serious defects

For eggs with dirty or broken shells, the standards of quality provide three additional qualities. These are:

Dirty	Check	Leaker
Unbroken May be dirty	Checked or cracked but not leaking	Broken so contents are leaking

* If they are small (aggregating not more than $\frac{1}{8}$ inch in diameter).

basis for developing grading systems. No attempt will be made here to give the percentages of the various qualities permitted in each dozen or case lot of eggs. The current standards should be checked for detailed specifications for quality and weight requirements for individual eggs in the various grade standards.¹⁰¹

Use of Personal Judgment

Most of the factors which must be considered in grading eggs are conditions that cannot be accurately defined. For instance, to determine whether an egg is "A" or "B" quality may be easy when it is well within the quality limits, but there are always a number of eggs that are so near to the line of distinction that it is difficult to determine in which grade they should be placed. The differentiation then becomes a matter of personal judgment. No two candlers are likely to grade the same lot of eggs indentially. They may grade them closely enough for practical purposes, but their grading is almost always different on borderline eggs.

If a candler has been looking at eggs of very poor quality for a considerable length of time and then runs across some eggs of average quality, these average eggs naturally are going to appear better to him than they would have if he had looked at them after looking at fine eggs. Relative differences, rather than absolute qualities, become factors in grading.

Among the most useful aids for guiding candlers are colored egg-candling charts or color transparencies. If these aids are consulted frequently, candling results are likely to become more nearly standardized. Judgment must be exercised when such devices are utilized, for the coloring in these reproductions cannot possibly cover all conditions, and the qualities of eggs vary so greatly that no one picture can represent the correct appearance of the conditions of all eggs of any one quality. Furthermore, the candled appearance of the egg contents is affected by such factors as the tint and thickness of the shell, type of light used, and darkness of the room.

Efforts have been made to eliminate this factor of personal judgment by introducing new methods for measuring interior quality. Blood-spot detectors have been developed recently by the U.S. Department of Agriculture, George Bliss of Page-Detroit, and others (Fig. 15). These machines are said to be capable of handling 20 cases of white eggs per hour. Another device for removing some of the objectionable eggs, particularly green rots, is the so-called "black light" candler. The ultraviolet rays produced by these lights enable the operator to readily detect the affected eggs.

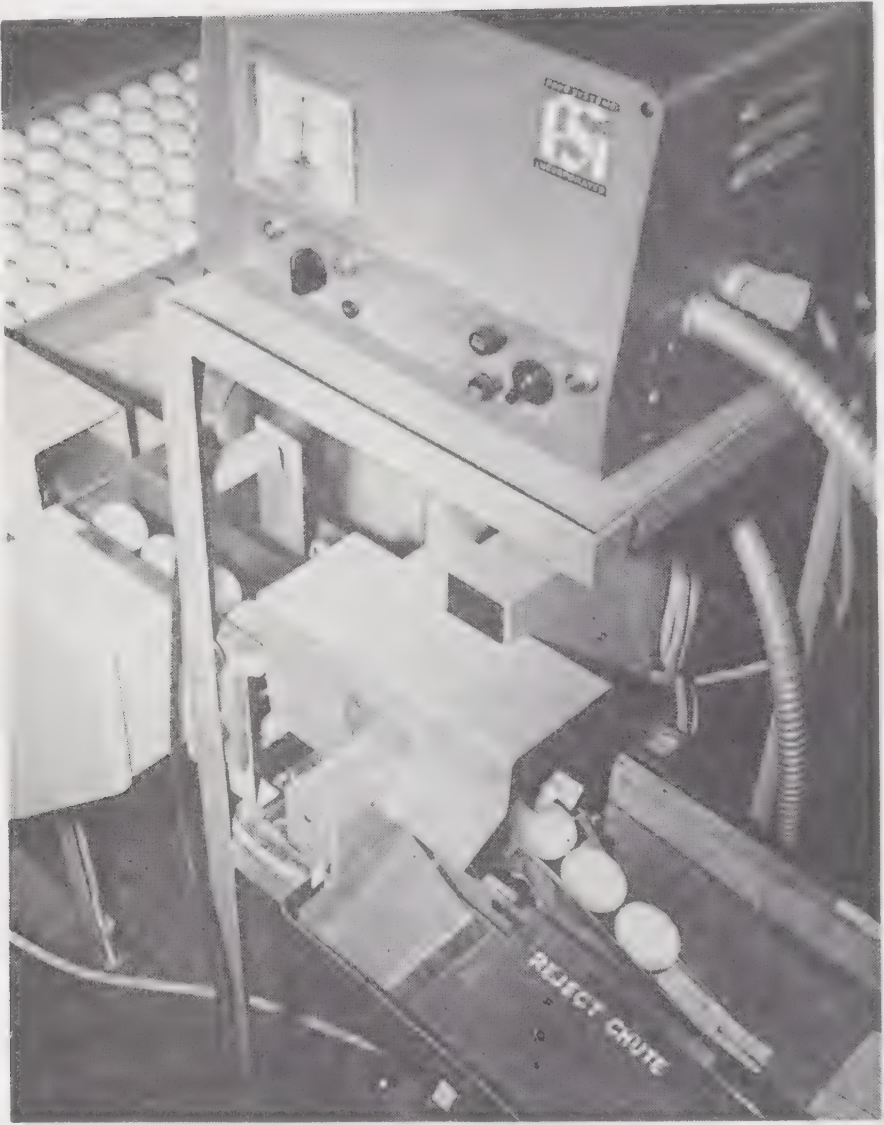


Fig. 15. Blood spot detector. (Courtesy Food Systems, Inc., Oakland, Calif.)

The possibility of more accurate removal of such objectionable eggs as those containing blood spots and white and green rots is likely to encourage the grading and packing of market eggs closer to the farm, with refrigerated protection from there to the consumer. With bloods, rots, checks, and paper-thin shelled eggs removed, and the eggs new laid, the relative importance of careful hand candling becomes lessened. Machine or belt candling will, under such conditions, often meet the requirements for preparing eggs for retail sale.

GRADING

Grading eggs consists of sorting them according to both exterior and interior quality factors. These operations are still performed by hand methods quite generally. Machines for automatic sorting as to size, soundness of shell, and freedom from blood spots, and tabulation of grading results have, however, become increasingly feasible as technical problems are overcome and as the marketing system has developed so that large volumes of eggs are being brought together into central grading stations.

Exterior Quality

The factors of soundness and cleanliness of shell, size, shell shape and texture and color are considered when determining exterior quality.

Soundness of shell. In grading, eggs with broken or dented shells are removed. Checks and cracks not easily noted by external observation are detected before the candling light or by "belling" the eggs—that is clicking two eggs together to determine whether the resulting sound is clear or bell-like in tone, or flat. A flat tone indicates that the egg is checked.

Cleanliness of shell. Clean eggs have more consumer appeal than dirty eggs. The cost of cleaning the eggs is well worthwhile for any edible market grades having sound shells.

Many types of egg-cleaning machines suitable for use in egg-grading and packing plants are available (Figs. 16, 17). All commercial machines provide instructions for operation. The fundamental principles involved are discussed on page 263.

Size. Eggs are usually graded as large, medium, and small. If a sufficient volume justifies the added cost, extra large and jumbo sizes as well as peewees are also separated. The U.S. Department of Agriculture has published a list of suggested weight classifications. These weights are: Jumbo, 30 ounces per dozen; Extra Large, 27 ounces; Large, 24 ounces; Medium, 21 ounces; Small, 18 ounces and Peewee, 15 ounces. Consumers apparently prefer eggs graded uniformly for size rather than eggs that are quite variable in this respect.

When hand methods are used, grading for size is usually done by visual inspection and feeling the weight of the egg in the hand. Eggs that are on the border line between one size group and another are checked by being placed on an individual egg scale. However, when

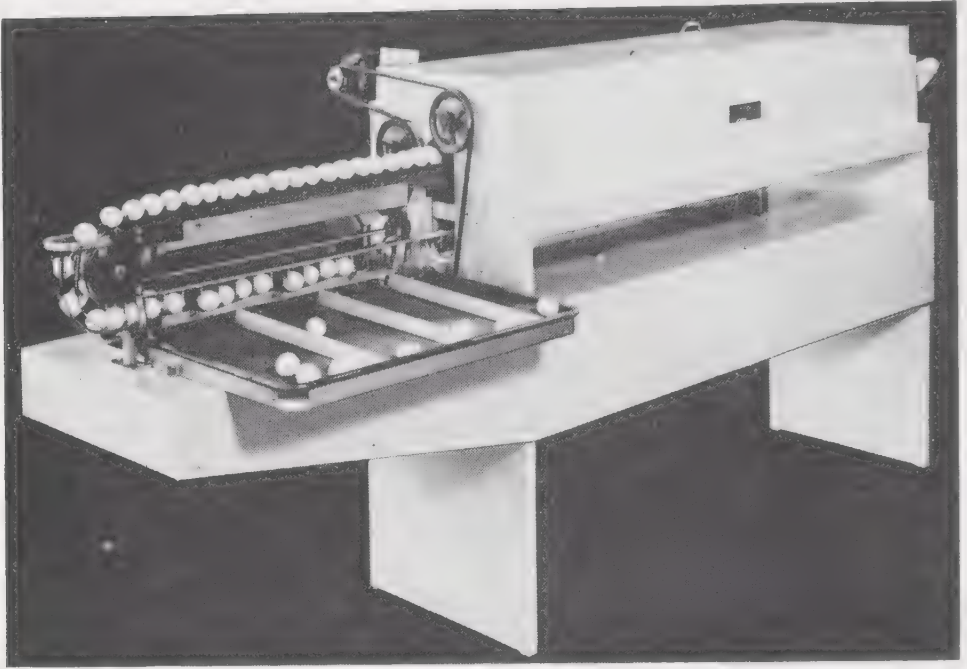


Fig. 16. Power egg dry-cleaner and grader combination for plant use. (Courtesy National Poultry Equipment Company, Renton, Wash.)

a person becomes proficient in grading eggs he rarely needs to use the egg scale.

In many commercial operations grading eggs into size classes is done by machine. Many kinds of machines are available with capacities of 4 to 20 cases or more per hour (Fig. 16). The advantages of such machines lie not only in their ability to handle a large number of cases per hour, but also in eliminating errors due to human judgment.

Shell shape and texture. Visual inspection is usually employed when grading eggs for shape and texture. Eggs that are misshapen, or rough or thin shelled are removed from the top grades.

Color of shell. Depending upon consumer preferences, it is sometimes profitable to grade eggs according to color of shell. Visual inspection and hand sorting are used for color grading, although colors can be separated by an electronic device utilizing an adaption of the electric eye.

Candling to Determine Interior Quality

The commercial method for determining the interior quality of a shell egg is by candling. This method consists of holding the egg before a suitable light and looking at the illuminated shell to determine

the condition of its content. This is usually done in a candling booth or other area of subdued light. Candling is not an infallible method for measuring interior quality because of the human-judgment factor and the necessity of estimating the opened egg condition by the color and lights and shadows seen through the shell. Greater accuracy is likely to result if the grader occasionally notes the candled appearance of a normal, fine, high quality egg as a standard with which to compare the other eggs. Frequently the grader can improve his quality interpretation by opening an occasional egg in order to correlate the opened quality with the candled appearance. Where egg-grading schools are available, occasional attendance by those supervising candling operations is also recommended. In commercial operations, when eggs are being candled into consumer grades without the use of automatic equipment, most graders can candle at least four cases per hour. Automatic equipment usually speeds up the operation considerably.

When selecting candling-room lights, proper illumination of the case and cartons should be provided for, as well as plenty of light at the candling aperture. The use of a candling light delivering 350 to 450 foot candles of light at the candling aperture is recommended. Candling lights with small apertures throw much sharper shadows of the egg contents than those with large openings. The amount of light passing into the egg as well as the focal length of the light rays affect the appearance of the shadow that the contents cast. No one type of lighting is likely to fit all circumstances. The usual source of light

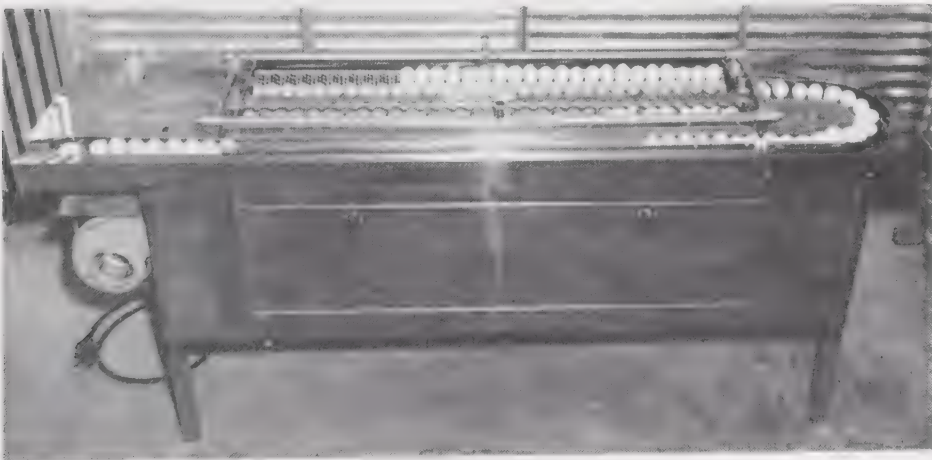


Fig. 17. Mechanical egg washer. (Courtesy H and P Egg Cleaner Mfg. Co., Sebastopol, Calif.)

for candling is the electric bulb, although any other source, even daylight, might be used.

In order to candle an egg correctly, it should be held at about elbow level, thus enabling the grader to note readily the size and condition of the air cell. The egg should be candled with the air cell upward and tilted slightly away from the grader. As the egg is placed before the light, it should be given a quick twirl in order to start the contents whirling. This motion makes the yolk, blood spots, and other contents easier to distinguish. Two eggs are usually held in each hand (Fig. 18). After one egg in the hand has been candled it is shifted back in a rotating motion to the palm of the hand, and the second egg is brought into candling position. The four eggs are candled by using the right and left hands alternately. A rhythm is usually developed making for greater proficiency.

Shell protection. This treatment consists of covering virtually the entire shell with a colorless, odorless, and almost tasteless light mineral oil. Various grades of this oil are offered to the industry by some of the major oil companies. Generally speaking, the more viscous oils seal the shell more completely but leave a noticeable sheen on the shell surface, sometimes objectionable to the consumer. The purpose of spraying or dipping the shells with this oil is to retain the original

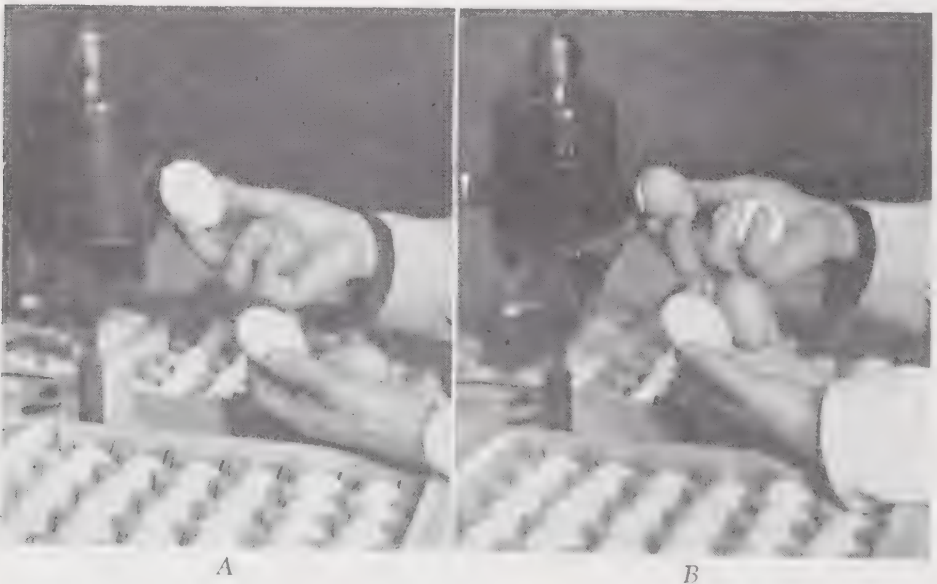
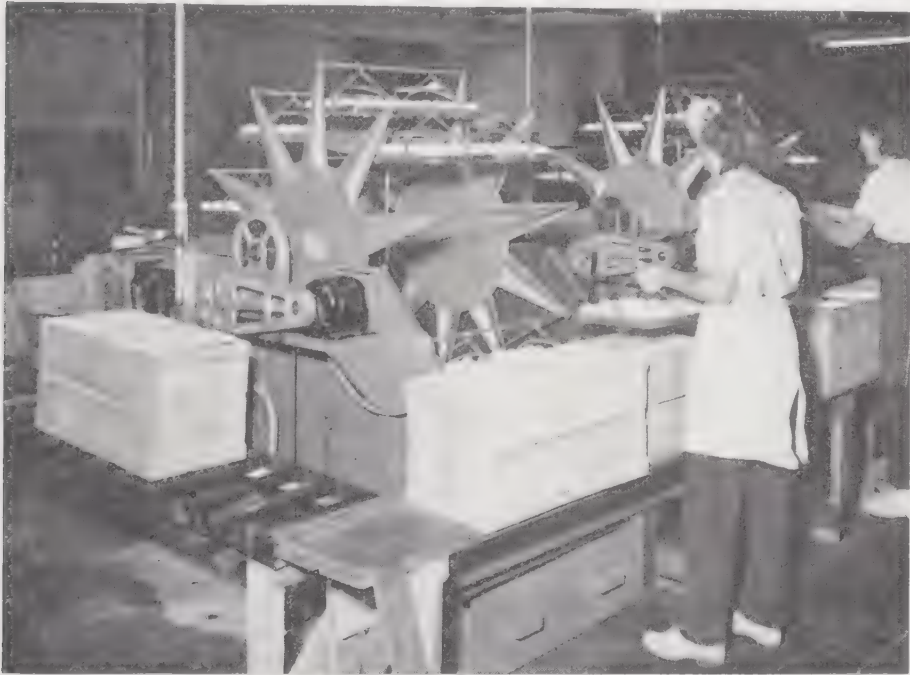


Fig. 18. Usual method of holding eggs for commercial candling. A. One white egg is being candled and the other is in position for candling; B, one brown egg is being candled while the other is being brought into position by rolling motion of hand.



A



B

Fig. 19. A, Automatic spray oiler for eggs. Capacity said to be 100 cases per hour to 500 cases per hour if used in candling line of that capacity. (Courtesy Food Saver, Inc., Adrian, Minn.) B, Revolving type of oil dipping machine. Smaller units, with the drum-wheel operated by hand, are available. (Courtesy Car-Pro Co., Los Angeles, Calif.)

carbon dioxide within the shell, which helps to keep the albumen firm, prevents the absorption of odors or flavors, and slows down the evaporation from the egg during storage or other holding that would cause enlargement of the air cell (Fig. 19).

The process of shell protecting in its modern form received great impetus when the large egg marketing cooperatives and other egg packers in the Pacific Coast and Midwest areas began shipping and storing high quality eggs for the eastern markets around the early twenties. Later, the U.S. Armed Forces encouraged the practice in

order to improve the keeping quality of the eggs they were purchasing. Now, the practice is being adapted to the current trend toward grading the eggs near the point of production and packaging them in consumer packages right there, so protected that they will hold up to required grade in the retail stores. Savings of costs are said to result from this method of operating.

In most cases the protecting is done in commercial plants, but in increasing instances it is being done with small units on the larger farms. (See pages 74 and 264.)

ADVANTAGES OF GRADING

Interstate trading and shipments of eggs are occurring constantly and in large volume. This situation creates a need for uniform standards throughout the country so that marketing may be facilitated and the efficiency of distribution increased. The U.S. Department of Agriculture and some state and industry leaders have for a number of years been encouraging the use of uniform standards and grades for eggs. That progress has been made is evidenced by the fact that a fair proportion of the eggs sold in wholesale and jobbing channels in the United States are graded on the basis of United States standards.¹⁰¹ In many instances eggs reaching the consumer are graded and marked according to United States standards and grades.

The principal advantage resulting from most traders using some official standards and grades for eggs is that they furnish an acceptable common language for trading and marketing the product, thus making possible:

1. Impartial official grading which sometimes may eliminate the need for personal inspection of the eggs by sellers and buyers.
2. Market price reporting in terms understood by all interested parties.
3. Negotiation of loans on generally accepted quality specifications.
4. A basis for settling disputes involving quality.

PREDETERMINATION OF GRADE THROUGH QUALITY CONTROL

The intense race to develop automation for the handling of eggs has placed a premium on eggs of uniformly high quality. At the present

time the U.S. Department of Agriculture is experimenting with the possibility of eliminating most of the candling for determining the interior quality of eggs.^{58, 95} In their early work much dependence is placed on requiring that:

1. The eggs be from pullet flocks of a strain producing eggs of good quality.
2. The handling of such eggs comply with strict regulations.
3. The standard for the flock and compliance with regulations be confirmed by frequent official inspections.

Although such a procedure could not be expected to meet the needs for any large proportion of all market eggs, it offers attractive possibilities for large producers of fine quality eggs. Such automation features as electronic removal of blood spots and green rots, and in-line cleaning, weighing, bulk candling, and packaging (Figs. 20, 21, 22, 23) all become more completely applicable and practical when eggs of uniformly high quality are being handled.

A special U.S. Department of Agriculture grade mark called "Fancy Fresh" is being considered for use with this program.



Fig. 20. Combination egg line. Operator at right feeds eggs on loader for conveying through cleaner, bulk inspection unit (Fig. 21), blood spot detector, and other units for final packaging in cartons or fillers for casing and delivery. Inset shows where air stream gently removes eggs from packaging conveyor and places them into cartons or fillers. (Courtesy Washington Cooperative Farmers Assn., Seattle, Wash.)



Fig. 21. Bulk candling unit of the combination egg line shown in Fig. 20.

PACKAGES

The basic purpose of packages is to provide an adequate yet economical container for the product in its journey from producer to consumer.

Wholesale Packages

Producers, country assemblers, and wholesale distributors usually use a fiber or wooden 30-dozen egg case. Prior to World War II the wooden veneer case was most commonly used, but since then the fiber case has almost completely replaced the wood because of its lower cost, lighter weight and easier handling.

Fiber egg cases. The principal types of materials used in making fiber egg cases are corrugated and solid fiberboard. These materials

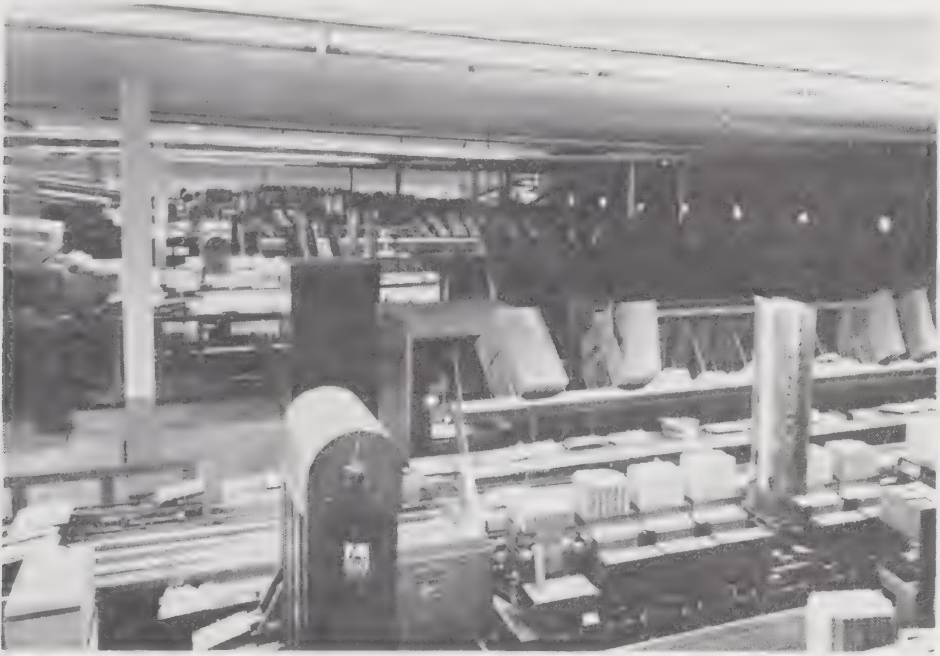


Fig. 22. Installation of automatic egg-handling equipment developed by Food Machinery and Chemical Corp. This equipment covers all operations from the case of eggs as received from the producer to the automatic loading of packed 15- or 30-dozen units into delivery trucks, controlled from an electronic order board. (Courtesy Poultry Producers of Central California, San Leandro, Calif.)

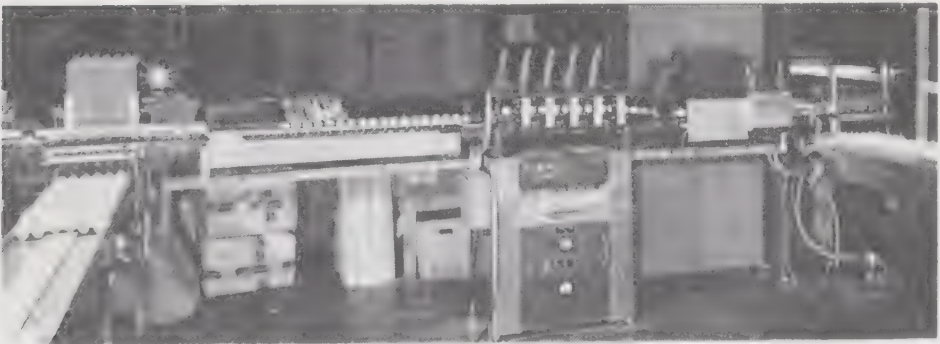


Fig. 23. Automatic egg-handling equipment produced by Page-Detroit, Inc. undergoing preliminary trials at a Cooperative Grange League Federation plant in New York State. Note various units from right: automatic egg aligner; crack detector, Bliss blood detector, size grader, candling strip, and first packing station. (Courtesy Page-Detroit, Inc., Detroit, Mich.)

are used in a variety of combinations and in a variety of thicknesses or weights of the material, in the production of egg cases for various purposes. The minimum inside dimensions of each compartment in a standard 30-dozen case are $11\frac{3}{4}$ inches square by 13 inches deep.¹⁰³ There are two major types of fiber cases produced—the so-called “standard” case (Fig. 24), and the “one-trip” or “truck” case. These are made in 30-dozen and 15-dozen egg sizes.

The standard case is designed to withstand rigorous handling and is approved for railroad shipment and storage. The “truck” case is made of lighter weight fiber and is of less rigid construction. It is not reusable, it has inadequate stacking strength for long-term storage, and it is not acceptable for rail shipment. Claims for in-transit damage in interstate truck shipments usually will not be honored if the “truck” case is used. However, since it is lower in cost than the standard fiber case, it is often used for short shipments and when no long holding in storage is involved.

Wooden egg cases. The principal kinds of wood used in making wooden egg cases are cottonwood and spruce. These are preferred



Fig. 24. Thirty-dozen and 15-dozen standard fiber egg cases. (U.S.D.A.)

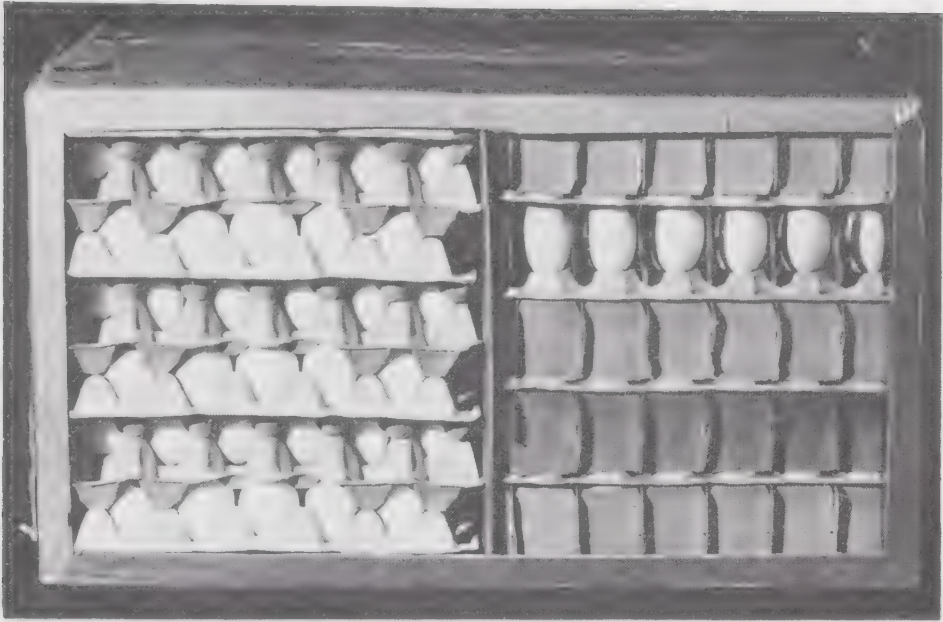


Fig. 25. A standard 30-dozen fiber case, side removed. Left side, an example of eggs packed in egg trays; right side, an example of eggs packed in cup flats and fillers. (U.S.D.A.)

because they are light in weight, tough, odorless, and light colored. Other woods used in their order of desirability are tupelo, hemlock, fir, gum, and basswood. The minimum dimensions of each compartment in a standard 30-dozen case are the same as for standard fiber cases. Wooden cases are strong, can stand rough handling, and are often reused many times. They have been used generally for export shipments. The egg case shook is purchased knocked down (K.D.) to save freight charges, and the cases are made up by the purchaser.

Inner packing materials. In both fiber and wooden egg cases, inner packing materials are used to separate the eggs from each other and to minimize breakage. For this purpose either cup flats and fillers or molded trays are used (Fig. 25).

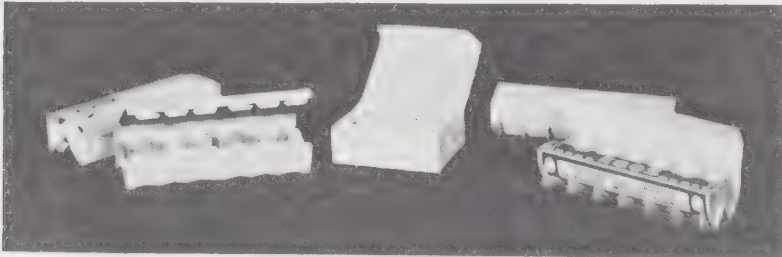
Fillers are strips of paperboard fastened so as to permit folding when not in use and to form individual square cells when spread out. Each filler has 36 cells for individual eggs, and for chicken eggs it is recommended¹⁰³ that the inside dimensions of each cell should be $1\frac{25}{32}$ inches square by $2\frac{15}{16}$ inches deep. Cup flats are square pieces of molded pulp, the tops of which constitute raised cups in which the small ends of the eggs rest. The bottoms of the cup flats constitute cushions which rest on the fillers below.

Egg trays are square pieces of molded pulp with posts or prongs on top and bottom. The prongs on the top form the lower half of the cells by which the eggs are held in place. The prongs on the bottom complete the cells for the individual eggs. Fillers are not used with trays, and packing entails only 14 pieces compared with 22 pieces when cup flats and fillers are used.

Retail Packages

Cartons are in general use for retail distribution of eggs. Each carton holds 12 eggs and the most popular style appears to be the so-called 2 x 6 carton which holds 2 rows of 6 eggs each. The other major type is the 3 x 4 carton which holds 3 rows of 4 eggs each, usually costing less than the 2 x 6 carton.

Chipboard and molded pulp cartons are generally used (Fig. 26). Experiments are now under way with cartons that have windows or are made entirely of clear plastic (Fig. 68). At least one research worker has been experimenting with producing retail packages for naked or shell-less eggs. The eggs are broken out of the shells and dropped into a series of clear plastic cups, and then along with an injection



A



B

Fig. 26. A, Examples of chipboard cartons; B, molded pulp cartons. (U.S.D.A.)



Fig. 27. A carton pack (30-dozen) with each layer alternated. (U.S.D.A.)

of carbon dioxide, a sheet of clear plastic is heat-sealed on the cups to form an airtight compartment for each egg.

Recently some firms have exhibited a renewed interest in overwrapping cartoned eggs with a plastic film. Attractive pictures of eggs in various cooked forms and other advertising may be printed in colors on the film. In addition to the greater sales appeal, the eggs in the carton may retain their original high quality longer because of the retention of carbon dioxide by the overwrap film.

Eggs in 2x6 cartons, when packaged at grading stations, are usually packed crosswise, alternating the layers, in 15-dozen or 30-dozen cases for shipment to retail stores (Fig. 27).

FACILITIES FOR GRADING AND PACKAGING

The facilities for grading and packaging eggs vary from makeshift candling booths in the back of country stores to modern buildings of special design with highly mechanized equipment. Essentially, they perform the same basic operations as described in the preceding sections.

The efficiency with which these operations are performed depends

on having the proper facilities for the volume handled and the ability of the manager to make proper use of the facilities. As larger and larger volumes are handled the cost per unit usually goes down, since fixed costs, such as overhead, are spread out over more of the units handled.

In egg assembly plants, candling room operations usually account for the greater part of the labor. These operations, as described earlier, may include candling, sizing, cleaning, oil protecting, and packaging. Facilities for performing these operations include the in-and-out movement of the eggs and the movement of packaging and other materials and supplies.

There are three general types of grading and packaging systems—bench, belt, and combination of the two.⁶²

Bench System

A bench on wheels with one candling light, shelves for egg cases, supplies, scales, and other equipment is one of the simplest types of facilities for grading eggs properly. Although this type of bench is used primarily for packing eggs in case lots, it may be used for small orders of cartoned eggs.

Push-pull bench system. This system is similar to the single or wall bench just described, except that the bench is wider, to allow for a depth of two egg cases. It is usually used where several candling stations are desired (Fig. 28) and where a larger volume of eggs is handled. The candler can have a reserve case of uncandled eggs

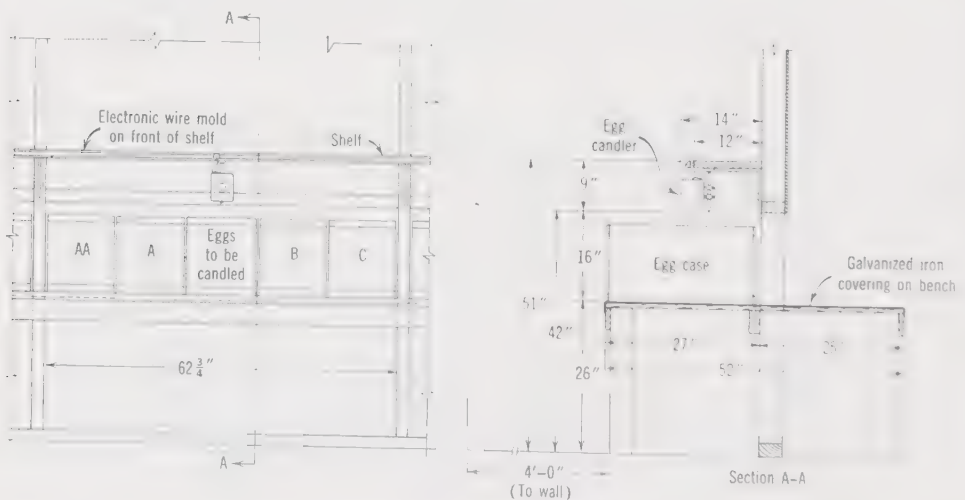


Fig. 28. Design of a push-pull type of candling bench. (Adapted from U.S.D.A., PMA design.)

available at all times. The candler pushes the finished cases under the partition into the lighted part of the room and then pulls the uncandled cases onto the work area. One person working in the lighted part of the room supplies the candlers with ungraded eggs and removes the graded product.

Belt System

In the most common type of belt system, the candling bench is basically the same as the push-pull bench. The added feature is the use of endless belt conveyors for transporting empty cartons and supplies to the work stations and cartons of candled eggs from the candlers to the packing area.

The belt system is used where eggs are cartoned, and it usually employs some type of carton set-up machine, carton closer, and a table for packing cartons of eggs into cases (Fig. 29). Numerous types and kinds of belt systems are used, but they all permit a higher degree of work specialization than the push-pull bench.⁶²

Combination Systems

In large plants handling a sufficient volume of eggs it becomes practical to add other operations to the belt line, such as transferring eggs from the fillers or trays to a conveyor so they are more convenient for the candler, removing dirty and cracked eggs, and sizing. Some conveyors are now being developed to include washing and drying, shell protecting, automatic cartoning, and tabulation of the number of eggs in the various classifications. Automatic removal of blood spots and the use of the "black light" when candling are being added to the above series of operations in some instances.

The high cost of hand operations for labor, breakage, and general loss of quality due to handling makes it imperative that each plant operator employ as much automation as his volume will warrant. Belt systems that include these multiple operations are often referred to as *combination systems* (Figs. 20, 21, 22, 23, 30). In setting up these combination systems, removal of checks, grading for size, washing and drying, and removal of blood spots are done before candling, and the oil protecting is done after candling.

MATERIALS HANDLING

Marketing costs can be reduced by careful attention to such operations as unloading and stacking of materials, convenience of work stations, and removing refuse.



Fig. 29. Eggs are candled from cases opened on the opposite side of the partition and pushed through in front of the candler. The filled cartons are placed on endless moving belts. Amber general lighting in this room dispenses with enclosed candling booths. (U.S.D.A.)

Crew Balance

Balance of crews is that arrangement and assignment of members of work crews and equipment whereby delay time and total labor requirements are minimized. Lack of crew balance in handling eggs and supplies can contribute to relatively high costs.

A study⁶² of an unbalanced operation showed that "The elapsed time required by the 7-man crew to break out of storage, transport and load 500 cases on the motor truck was 50 minutes. The total labor required was 5.83 man-hours. The same elapsed time was required by use of the 5-man crew, because the 2 men who were idle were eliminated, but the total labor requirements were reduced to 4.16 man-hours or a reduction of 28.65 percent."

Unit Load

Another aid in making materials handling more efficient is the unit load. "A unit load is made up of several packages grouped together so that they may be handled as a unit for unloading, transporting, stacking, or loading operations, or through any combination of these operations, rather than as individual packages."⁶² An illustration of the savings that can be made is shown in Fig. 31.

Advantages of the unit load are: (1) there is a reduction in the number of times individual cases of eggs are handled, (2) large loads can be handled by using certain types of equipment, which results in reducing the number of trips needed to transport a given quantity of eggs, (3) the job of taking an inventory is simplified, and (4) the amount of deterioration in quality and breakage is reduced, because the cases of eggs are handled a fewer number of times. However, the unit-load principle should not be applied blindly. The volume to be handled, seasonality of the operation, costs, and other factors need to be considered in selecting the proper method of performing the job to be done.

Mechanical Equipment

Efficiency and economy in handling eggs and related packaging materials are obtained by using mechanical equipment in place of manpower wherever practicable. There is a wide choice of equipment—hand trucks, conveyors, skids, pallets, and hand-lift and fork-



Fig. 30. Work station at rotary carton-packing table also showing automatic carton sealer. (U.S.D.A.)

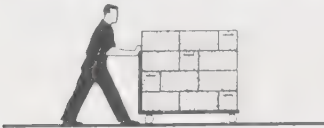
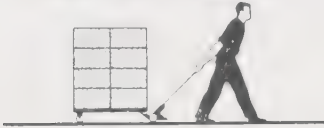
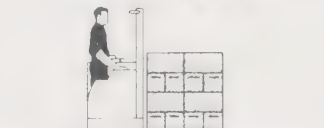
Methods	Cases per Load, number	Round Trip (200 Feet), minutes	Loads, number	Total Time hours
	1	0.58	500	4.83
	4	0.65	125	1.35
	20	0.77	25	0.32
	24	0.75	21	0.27
	24	0.53	21	0.18

Fig. 31. Comparative elapsed times required to transport 500 cases of eggs a distance of 100 feet by use of various methods. (Adapted from U.S.D.A. diagram.)

lift trucks. The type, or combination of equipment types needed, is dependent on the volume handled and the physical plant facilities.⁶²

Movement of Supplies

A plant layout incorporating wide aisles, easy turns, platforms of adequate width and height, and ample approaches to doorways of adequate size permitting two units of equipment to pass, increases the productivity of mobile equipment by permitting increased speed, smoother and more direct continuity of work, less congestion, and safer working conditions.

Preventive Maintenance

The productivity of equipment is increased when repairs are anticipated and worn parts are replaced so as to prevent interruption of operations. As the term implies, preventive maintenance consists of proper care, including lubrication, to keep equipment mechanically fit so that breakdowns may be minimized.

Plant Layout

It is usually necessary to adapt an existing plant to the operations to be performed. The principles previously described can be applied to such a problem.

Many factors need to be considered in designing and locating a new plant, and usually it is advisable to obtain competent technical advice⁸¹ (Fig. 32).

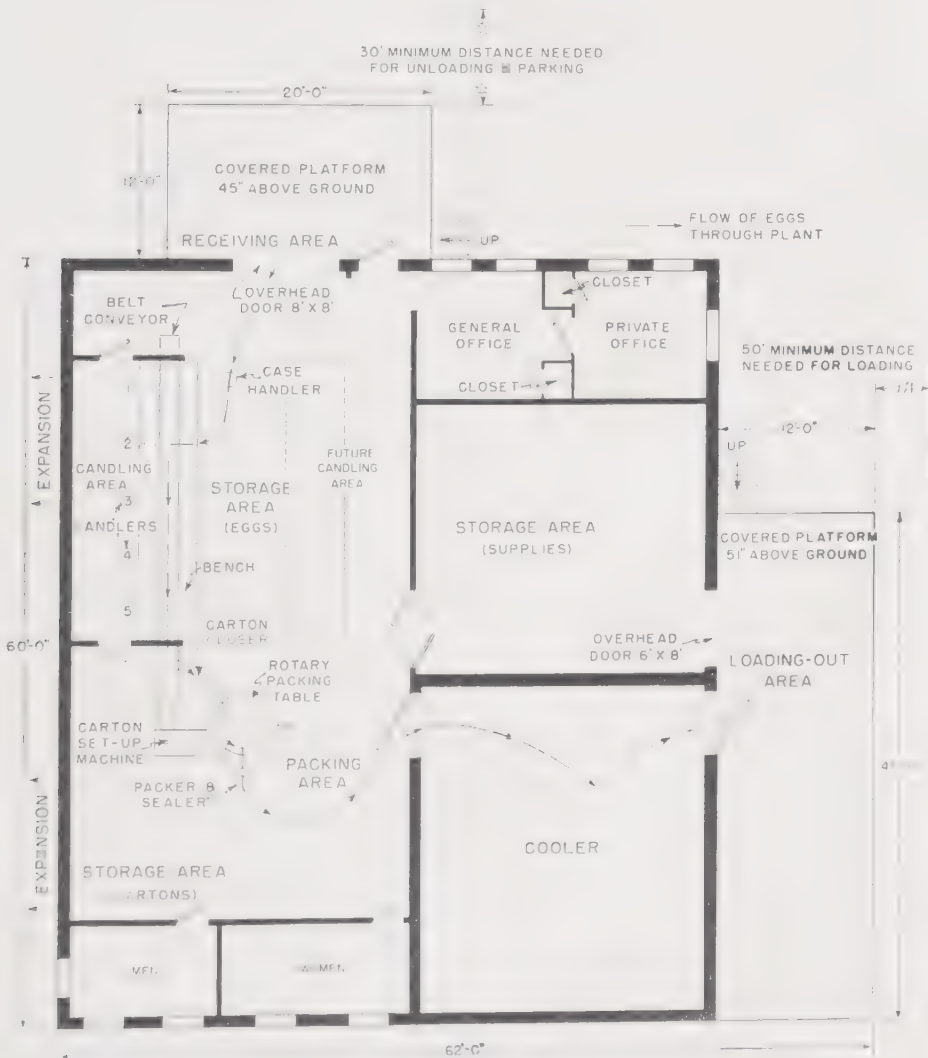


Fig. 32. Layout for a medium-size egg grading and packing plant adaptable for future expansion. (U.S.D.A.)

COMPUTING COSTS OF GRADING AND PACKAGING

Costs vary with changes in the price level, productivity of labor and facilities, scale of operation, and many other factors. Therefore, no attempt will be made to say that it costs so many cents per dozen to candle eggs under certain conditions. Rather, two examples will be given of methods of computing costs as a guide to those who may not be aware of the methods usually employed. With the industry becoming more and more competitive, awareness of one's costs becomes increasingly important.

A Midwestern assembler of eggs may pay \$12.00 per 30-dozen case for eggs. He grades the eggs and sells the Grade A Large eggs for 55 cents a dozen. Has he made any money? To answer the question some assumptions need to be made. The following calculations will illustrate the principles involved and then the assumptions will be examined.

Grading Yield and Selling Prices

Grade A Large	24 doz @ 55¢	\$13.20
Grade B	3 doz @ 40¢	1.20
Grade C	1 doz @ 30¢	.30
Checks	1½ doz @ 25¢	.125
Loss	1½ doz @ 0	.00
Total return		\$14.825 (49.4¢ per doz)
Cost of purchase	30 doz @ 40¢	12.000 (40.0¢ per doz)
Difference or amount to cover costs and profit		\$ 2.825 (9.4¢ per doz)
Direct operating costs per 30-doz case:		
Commissions to station buyers		\$.30 to \$.45
Truck costs for assembling eggs		.20 to .30
Candling @ \$1.20 per hr (Avg. 4 cases per hr)		.25 to .35
Fiber egg cases and packing supplies		.50 to .70
Delivery to buyers in distant cities		.45 to .90
Indirect costs per case:		
Plant overhead		.15 to .30
Total cost per case		\$1.85 to \$3.00
(cost per doz 6.2¢ to 10.0¢)		
Amount required to cover costs and profit		\$2.825
Balance: range from profit of \$.975 to a loss of \$.175 per case according to the circumstances involved		

In this example it is assumed that the eggs were purchased and sold at current market prices for average to good eggs and that the grading yield was 80 per cent Grade A Large with proportional yields of undergrades. In the cost assumptions, the indirect costs would go on whether or not any eggs were handled. The direct costs would be influenced by the circumstances concerned, volume handled, efficiency of the plant, facilities, labor, and the skill of the manager. One apparent way to eliminate the loss or increase the profit would be by reducing costs. This could be accomplished by handling a larger volume of eggs through the same facilities, increasing the efficiency of the handling operations, or possibly relocating the plant.

In the second example, a country assembler of eggs buys them from farmers. The farmers have cleaned the eggs and graded them for size. The assembler pays the farmers \$14.85 per 30-dozen case for large eggs of generally high quality. These eggs may be classed as "henneries" or "nearbys" and if of very fine quality would contain 10 per cent or more of Grade AA eggs and a total yield of Grades AA and A exceeding 90 per cent. The assembler did not grade the eggs but sold them to a wholesale receiver in a nearby market for \$16.95 per case. Did the country assembler make any money?

Selling price, per 30-doz case	\$16.95 (56½¢ per doz)
Purchase price	14.85 (49½¢ per doz)
Amount to cover costs and profit	\$ 2.10 (7¢ per doz)

Direct operating costs per 30-doz case:	
Truck costs for assembling eggs	\$.20 to \$.30
Fiber egg cases and packing supplies	.50 to .70
Plant labor	.10 to .20
Delivery to city buyers	.15 to .45

Indirect costs per case:	
Plant overhead	.15 to .30

Total cost per case	\$1.10 to \$1.95
(cost per doz. \$.037 to \$.065)	
Amount required to cover costs and profit	\$2.10

Balance: range from profit of \$1.00 to a profit of \$.15 per case according to the circumstances involved

In comparing these two examples it should be noted that in the second instance: (1) the farmers themselves performed certain marketing services by cleaning the eggs and grading them for size; (2) the

added cost of commissions or salaries to station buyers was eliminated; (3) the grading loss was passed on to the buyer; and (4) with better quality eggs, probably from larger producers, a smaller gross profit could be accepted because there was less risk of unforeseen costs cropping up.

Questions

1. What quality factors are used in grading eggs?
2. What is the best method of determining the interior quality of a shell egg?
3. What are the United States weight classes for shell eggs? List the minimum weight for each class in ounces per dozen.
4. Go to a poultry farm and observe or grade the eggs for weight. What per cent of the total production for the day is in each weight class?
5. Discuss the advantages of using official standards and grades for eggs.
6. How many cases of eggs can be candled in an hour by a commercial candler and upon what does this speed depend?
7. What are the advantages of oil-protecting eggs?
8. List some of the differences you have observed in fiber egg cases.
9. Go to at least two retail stores, and observe and describe retail packages used for eggs.
10. Grade some eggs at the farm and find the per cent that are cracked or that have poor shells. Use one day's production if possible.

Supplementary Reading

- Hamann, J. A., E. R. Winter, R. Stoyanoff, and O. C. Hester, "Electronic Blood-spot Detection in Commercial Egg Grading," *U.S.D.A., AMS Marketing Research Rept.* 239, June 1958.
- Hauver, W. E., Jr., and J. A. Hamann, "Egg Grading Manual," *U.S.D.A., AMS Agr. Handbook* 75, October 1955.
- Hester, O. C., "Changing Technology in Egg Marketing," *U.S.D.A., AMS* 241, April 1958.
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The Egg Products Industry

The production of liquid, frozen, and egg solids (dried eggs) has assumed an important position in egg marketing through the years. As a result of the shortage of shipping space during World War II, the production of egg solids was especially greatly increased. Since then continued activity in the industry has resulted from the convenience, low cost, and various improvements of quality. Brand new products such as cake mixes have been developed.

Manufacturers of noodles, mayonnaise, candy, baked goods, and other food items, find it easier to purchase frozen, liquid eggs, or egg solids, than to purchase eggs in the shell and break them out. In addition, the producers of frozen eggs and egg solids have found it more economical to buy eggs in the flush of springtime production, break them out, and freeze or dry them, than to buy shell eggs for this purpose in all months of the year. The purchases of shell eggs by egg breakers in the spring months are an important factor in stabilizing or setting a floor under egg prices to producers.

BACKGROUND AND GROWTH OF THE INDUSTRY

The history of the egg products industry is a good example of how supply and demand and international conditions affect the handling and processing of a food product.⁴⁸ Commercial freezing of eggs began about 1890, but it did not begin rapid growth until World War I. Drying of eggs had developed significantly some 15 years earlier, and patents were sought for it as early as the Civil War. During World War I, however, solids were imported from China. The solids industry in this country remained relatively small until 1927 when war arose in China. A marked increase in production occurred in 1932 following an increase in tariffs and a decline in domestic prices of shell eggs. With the advent of World War II, production reached an all-time high in 1944. From that year, production has declined,

but in recent years it has apparently stabilized at approximately double the level reached prior to World War II.

From 1942 to 1944, the production of liquid eggs accounted for 1 out of every 5 eggs produced on farms. Production of liquid eggs in recent years has been maintained at more than 400 million pounds per year or approximately twice the prewar level, and it has accounted for 7 per cent of the eggs produced on farms (Table 8). Frozen eggs are prepared from approximately three-fourths of the liquid eggs pro-

Table 8. Liquid Eggs: Production, Disposition, and a Comparison with Eggs Produced on Farms, 1938-1957

Disposition						Liquid Eggs Produced for All Purposes as Per Cent of Farm Egg Production
Year	Total Liquid Egg Production	Frozen	Used for Drying	For Immediate Consumption	Frozen Eggs Later Dried	
<i>Million Pounds</i>						<i>Per Cent</i>
1938	149	116	22	11	...	3.8
1939	220	177	31	12	...	5.4
1940	229	189	27	13	...	5.5
1941	422	237	166	19	...	9.7
1942	1,011	258	731	22	116	20.0
1943	1,222	413	782	27	159	21.5
1944	1,554	512	1,009	33	179	25.5
1945	682	398	265	19	122	11.6
1946	788	392	376	20	84	13.5
1947	682	371	295	16	21	11.8
1948	502	345	140	17	25	8.8
1949	588	318	251	19	32	10.0
1950	697	354	323	20	32	11.3
1951	409	340	51	18	23	6.6
1952	382	320	44	18	32	6.2
1953	411	343	47	21	...	6.6
1954	466	361	74	31	...	7.4
1955	453	342	79	33	...	7.1
1956	465	349	83	33	...	7.1
1957	475	334	103	38	...	7.3
1958	471	341	99	31	...	7.2

Source: U.S.D.A., AMS, *Liquid, Frozen, and Egg Solids Production*.

duced during peace time, overshadowing greatly the use of liquid eggs for the production of solids.

The large volume users of egg products such as the baking, mayonnaise, noodle, candy, baby food, and cake mix manufacturers, have greatly contributed to the economic growth of the egg products industry. Another factor of importance has been the protective tariff of 1930 (Hawley-Smoot) and the presidential proclamation of 1931, which increased the tariff on dried eggs even more (Table 9). These tariffs, and in addition World War II, effectively reduced the competition from China, and as a result imports have been very small during the last 20 years. Imports of egg products increased in 1949 and 1950, probably as a result of the reduction in tariffs; but they dropped to insignificant amounts in 1951 and later years, probably again as a result of restoration of the high tariffs, lack of trade relations with Red China, and the increasing superiority of American-made egg solids, particularly albumen solids. Exports of egg products became significant only during World War II, when they reached a peak of 245 million pounds in 1944. Since then they have dwindled to very small amounts because of increased United States demand and the fact that the Chinese products generally sell for less than the United States products in the world markets.

LOCATION OF THE INDUSTRY

The firms that have survived in this highly competitive industry tended to be those located in areas of lowest prices for eggs. This area is located in the Midwestern states, and the location of the egg breakers is as shown in Fig. 33. Egg-breaking firms located in terminal markets have gradually declined in number. However, in large-scale egg-candling operations where eggs are graded into consumer grades and cartoned, eggs that cannot be put into the cartons can often be utilized by breaking and disposal as liquid or frozen eggs.

SEASONALITY OF PRODUCTION AND PRICES

The main production season for egg products is March through June. For example, two thirds of the production of frozen eggs occurred during these 4 months in 1954-1958. Some production occurred in every month of the year, but it reached a low of less than 2 per cent in November (Table 10 and Fig. 34). Within the past year or

Table 9. Egg Products: Comparison of Exports and Imports with Production 1930-1958

Year	Exports of Egg Products	Imports of Egg Products	Exports and Imports as a Percentage of Farm Production		Tariffs on Imports	
			Exports	Imports	Egg Solids	Frozen
	<i>Million Pounds</i>		<i>Per Cent</i>		<i>Cents Per Pound</i>	
1930	*	16	†	0.4	18	11
1931	*	8	†	0.2	27	11
1932	*	3	†	†	27	11
1933	*	4	†	0.1	27	11
1934	*	3	†	†	27	11
1935	*	8	†	0.2	27	11
1936	*	9	†	0.3	27	11
1937	*	10	†	0.3	27	11
1938	*	2	†	†	27	11
1939	*	1	†	†	27	11
1940	*	3	†	†	27	11
1941	75	3	1.7	†	27	11
1942	160	1	3.2	†	27	11
1943	234	*	4.1	†	27	11
1944	245	*	4.0	†	27	11
1945	143	*	2.4	†	27	11
1946	118	*	2.0	†	27	11
1947	63	*	1.1	†	27	11
1948	41	*	0.7	†	17	7
1949	28	2	0.5	†	17	7
1950	49	8	0.8	0.1	17	7
1951	49	*	0.8	†	27	11
1952	7	*	0.1	†	27	11
1953	3	0.6	†	†	27	11
1954	2	*	†	†	27	11
1955	1	*	†	†	27	11
1956	3	*	†	†	27	11
1957	2	*	†	†	27	11
1958	1	*	†	†	27	11

* Less than 500,000 pounds.

† Less than one tenth of one per cent.

Source: U.S.D.A., Foreign Agriculture Service.



Fig. 33. Location of egg-breaking plants operating under the egg products inspection program of the U.S. Department of Agriculture, 1956. (U.S.D.A.)

two an increasing number of firms have begun production of egg products on a year-round basis.

Storage holdings of egg products give further evidence of the seasonality of production. Frozen egg peak holdings were reached at the end of July during 1954–1958; and the low point during those same years was reached at the end of February (Table 11).

The composition of the storage holding of shell, frozen, and egg solids shows the predominance of the egg products. During 1954–1958 shell egg storage holdings reached their peak at the end of June, but even at that peak level they accounted for only 25 per cent of the combined holdings of shell, frozen, and solids.

Prices of eggs in the West North Central region, the area in which most of the egg products are produced, during 1954–1958 reached their lowest levels during July. The peak price was reached in February (Table 12 and Fig. 34). It is more economical to break out and freeze or dry the egg meats during the spring period and in the area of low prices, than to produce a uniform amount in each month of the year or in areas of high prices (except for undergrades from candling operations). Sometimes, as in 1956, when fall egg prices were relatively low, greater-than-normal quantities of egg products

Table 10. Products: Annual Production 1954-1958, and Seasonality of Production

Year or Month	Frozen Whole Egg	Frozen Yolks	Frozen Albu- men	Total Frozen Egg Produced	Whole Egg Solids	Yolk Solids	Albu- men Solids	Total Egg Solids Produced
<i>Million Pounds</i>								
1954	162	89	110	361	3	11	9	23
1955	152	89	101	342	3	9	11	23
1956	157	83	109	349	5	8	9	22
1957	149	83	102	334	10	9	10	29
1958	155	89	107	351	8	8	9	25
Average	155	86	106	347	6	9	9	24
<i>Seasonality of Production *</i>								
<i>Per Cent</i>								
Jan.	4.9	4.8	5.1	4.9	5.2	8.2	6.5	6.8
Feb.	7.6	8.0	8.0	7.8	3.4	8.9	9.6	7.9
March	14.4	14.2	15.0	14.5	7.3	12.4	10.8	10.5
Apr.	17.0	18.2	18.5	17.8	13.8	12.5	13.5	13.2
May	18.3	19.5	20.5	19.3	15.6	12.8	13.5	13.7
June	14.1	16.5	15.9	15.3	15.1	11.8	10.5	12.1
July	7.9	8.4	7.0	7.7	10.9	9.3	8.2	9.3
Aug.	4.7	3.8	3.4	4.1	6.7	6.4	7.0	6.7
Sept.	2.9	1.8	1.9	2.3	3.4	5.4	5.5	5.0
Oct.	2.8	1.7	1.5	2.2	4.1	4.2	5.8	4.8
Nov.	2.2	1.2	1.2	1.6	6.1	3.6	4.1	4.4
Dec.	3.2	1.9	2.0	2.5	8.4	4.5	5.0	5.6
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Average per cent of annual for respective months.
Source: U.S.D.A., AMS, *Liquid, Frozen, and Egg Solids Production*.

are produced during the fall. High quality eggs are often broken out for freezing or drying to produce special packs for the armed forces, baby food manufacturers, and other outlets; the trend is toward increasing volumes of egg products from top quality stock.

Prices of egg products, like prices of other commodities, are a result of supply and demand. Prices of these products in the spring months are related to prices of the raw product, shell eggs, and anticipated demand for the finished product in later months. Contracts with large users are frequently made in the late winter or early spring months for later delivery, and these contracts tend to lend a stabilizing influence to prices. In the fall months, egg product prices are related

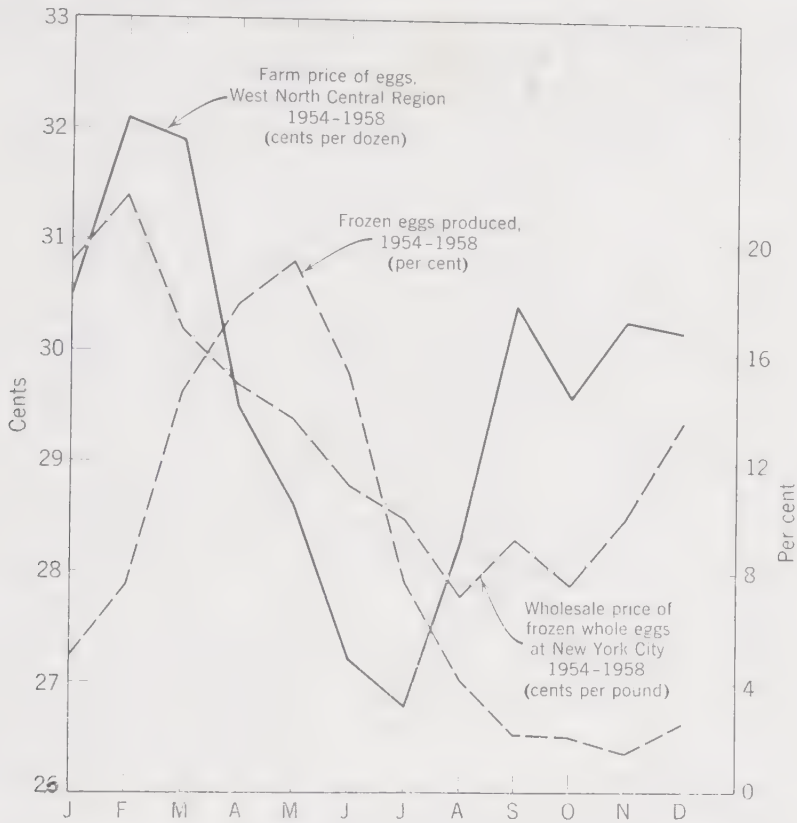


Fig. 34. Seasonality of production of frozen whole eggs, wholesale price of frozen whole eggs at New York City, and farm price of eggs in the West North Central Region, 1954-1958. (Adapted from U.S.D.A. data.)

to the spring months' prices plus storage costs when supply and demand are in approximate balance. "Windfall" profits or losses may be realized when supply and demand are not in balance during the fall months. In that season production is seasonally low and the demand may be greater or less than anticipated in the previous spring months.

OPERATIONS IN PRODUCING LIQUID AND FROZEN EGGS
AND EGG SOLIDS

The basic operations performed in producing the commercial egg products are: (1) receiving shell eggs, (2) candling to sort out eggs unfit for human consumption, (3) cleaning of dirty shell eggs, (4) breaking the shell eggs and removal of contents, (5) inspection of the egg meats by sight and smell, (6) separation of yolks and

Table 11. Cold Storage Holdings: Eggs and Egg Products, Monthly Averages, 1954-1958

Year or Month	Actual Counts			Converted to Shell Egg Equivalents			Totals, 1,000 cases
	Shell Eggs, 1,000 cases	Frozen Eggs, 1,000 lb	Dried Solids, 1,000 lb	Shell Eggs, 1,000 cases	Frozen Eggs, 1,000 cases	Dried Solids, 1,000 cases	
1954	736	119,122	2,555	736	3,094	251	4,081
1955	1,071	128,056	3,929	1,071	3,326	385	4,782
1956	723	115,484	4,253	723	2,999	417	4,139
1957	930	118,398	4,331	930	3,075	425	4,430
1958	344	91,143	1,698	344	2,307	157	2,808
Average	761	114,441	3,353	761	2,960	327	4,048
Per cent	...	...	...	18.8	73.1	8.1	100.0
<i>Percentage Distributions of Monthly Averages, 1954-1958</i>							
Jan.	2.4	4.3	5.2	11.4	78.1	10.5	100.0
Feb.	2.9	4.0	5.0	14.4	75.3	10.5	100.0
March	4.9	5.4	5.4	17.5	74.2	8.3	100.0
Apr.	8.9	7.8	6.7	21.3	71.8	6.9	100.0
May	15.5	10.4	9.2	25.7	67.7	6.6	100.0
June	17.7	12.4	11.6	24.8	68.2	7.0	100.0
July	15.7	12.6	12.5	22.3	70.0	7.7	100.0
Aug.	11.8	11.7	12.2	18.8	72.9	8.3	100.0
Sept.	8.5	10.3	10.1	16.0	75.9	8.1	100.0
Oct.	6.2	8.7	8.4	14.2	77.5	8.3	100.0
Nov.	3.6	7.0	7.3	10.7	80.1	9.2	100.0
Dec.	1.9	5.4	6.4	7.6	81.7	10.7	100.0
Totals	100.0	100.0	100.0	...	...	...	...
Average	...	...	...	18.8	73.1	8.1	100.0

Source: Computed from data in monthly issues of the *Cold Storage Report*, U.S.D.A.

whites when desired, (7) mixing or churning of yolks and whites when desired, (8) straining to remove the chalazas and pieces of shell and shell membranes, (9) pasteurization, (10) addition of sugar, salt, or other ingredients, and (11) freezing or drying the product.

The modern egg-breaking plant is operated under strict sanitary conditions.²⁹ At any time during the operations performed, unless proper precautions are taken, contamination by bacteria may occur in

sufficient degree to initiate decomposition. Plant facilities for breaking shell eggs are especially designed and equipped to speed handling and processing operations in order to minimize impairment of the original quality of the eggs.

Receiving Shell Eggs

Eggs received at the breaking plant are placed as quickly as possible into a refrigerated cooler maintained at about 40° F. This preliminary cooling minimizes bacterial growth during further operations and facilitates separation of yolks and whites when that operation is performed.

Candling

The chilled eggs are moved to the candling room which is preferably maintained at 60° F. At this temperature the eggs do not warm up

Table 12. Farm Prices for Shell Eggs in the West North Central Region and Prices of Frozen and Dried (Egg Solids) at New York City, 1954-1958

		Prices at New York City					
Month	Farm Price, W.N.C. Region	Frozen Whole Eggs	Frozen Plain Yolks	Frozen Whites	Dried Whole Eggs	Dried Yolks	Dried Flake Albumen
Cents per Doz		Cents per Lb			Cents per Lb		
Jan.	30.5	30.8	53.9	19.9	123	120	172
Feb.	32.1	31.4	53.7	19.8	124	119	171
March	31.9	30.2	52.7	19.2	122	114	165
Apr.	29.5	29.7	50.7	18.2	120	112	157
May	28.6	29.4	50.9	17.8	118	112	154
June	27.2	28.8	50.9	17.1	115	110	157
July	26.8	28.5	51.4	16.8	113	112	146
Aug.	28.3	27.8	51.4	16.5	111	111	145
Sept.	30.4	28.3	52.0	16.9	111	112	145
Oct.	29.6	27.9	52.5	16.8	111	113	143
Nov.	30.3	28.5	53.3	17.1	114	116	144
Dec.	30.2	29.4	53.1	17.6	118	119	151
Average	29.6	29.2	52.2	17.8	117	114	154

Source: Computed from data given in *Agricultural Prices*, and *Dairy and Poultry Market Statistics*, U.S.D.A.

appreciably, and it helps prevent "sweating" or the condensation of moisture upon the shells. "Flash" candling, a term applied to candling done rapidly, is used to sort out the inedible eggs, dirties, checks, and leakers.

Cleaning

Dirty shell eggs are washed and sanitized prior to breaking so that the ever present possibility of bacterial contamination is minimized.

Egg Breaking

The shell eggs are usually broken by trained women under expert supervision (Fig. 35). The shell eggs are broken against a knife and the egg meats are dropped into small metal cups. When the eggs are broken, the breaker examines them by sight and smell to determine acceptance or rejection. A keen sense of smell is needed to detect mustiness, sourness, fruitiness, or other foreign odors, because one mistake may spoil a whole 30-pound can of eggs. A fairly recent development in this field is a machine that automatically grades, washes, and breaks eggs. (Fig. 36).

Separation of Yolks and Whites

For the production of separated yolks and whites, the breaker drops the contents of the opened egg upon a separator spoon just large enough to hold the yolk. The white of the egg separates from the



Fig. 35. Three complete lines of breaking conveyors have been installed in this breaking room. There are a total of one hundred four breaking positions. Eggs are fed automatically on a conveyor belt. (Courtesy Tranin Egg Products Company, Kansas City, Mo.)



Fig. 36. Automatic egg grading, washing, breaking, and separating machine. Light and dark yolks are separated automatically by this machine. An air jet removes adhering, edible albumen from the opened shells. (Courtesy Seymour Foods, Inc., Topeka, Kan.)

yolk and drops to a cup below. A small hinged ring is brought over the yolk to clip any remaining thick albumen from it. The shells are dropped into cans or onto a conveyor belt for disposal. The yolks and whites are processed further separately.

Churning

The acceptable whole egg meats or yolks are moved in small buckets to a churn which makes the product more uniform and homogenous without beating air into it. Since normal operation may alter its beating quality, albumen is given only a short churning. When the albumen is to be used for certain purposes it may be passed through a mill which eliminates the thick white and produces a homogenous product. The egg meats are then strained and placed in cans and the cans are weighed.

Pasteurizing

The presence of *Salmonella* bacteria in egg products has caused some concern in recent years, although little evidence is available to

indicate infection from this source. The possibility of contamination by these bacteria has led to developing methods to assure extreme cleanliness and pasteurization as an added safeguard.

An effective method of pasteurizing liquid whole egg has been reported,²⁸ which employs the type of equipment used for pasteurizing milk with little change in the equipment and operational procedures. The study showed that a temperature of 140° F is the most dependable one to use under existing commercial plant operations. A holding period of 3 minutes following flash pasteurization to 140° F is satisfactory for the elimination of *Salmonella* types of bacteria from liquid whole egg, and this holding period appears to provide a margin of safety in operation. The functional properties of the resulting liquid egg are affected very little and the keeping qualities are markedly improved.

Freezing

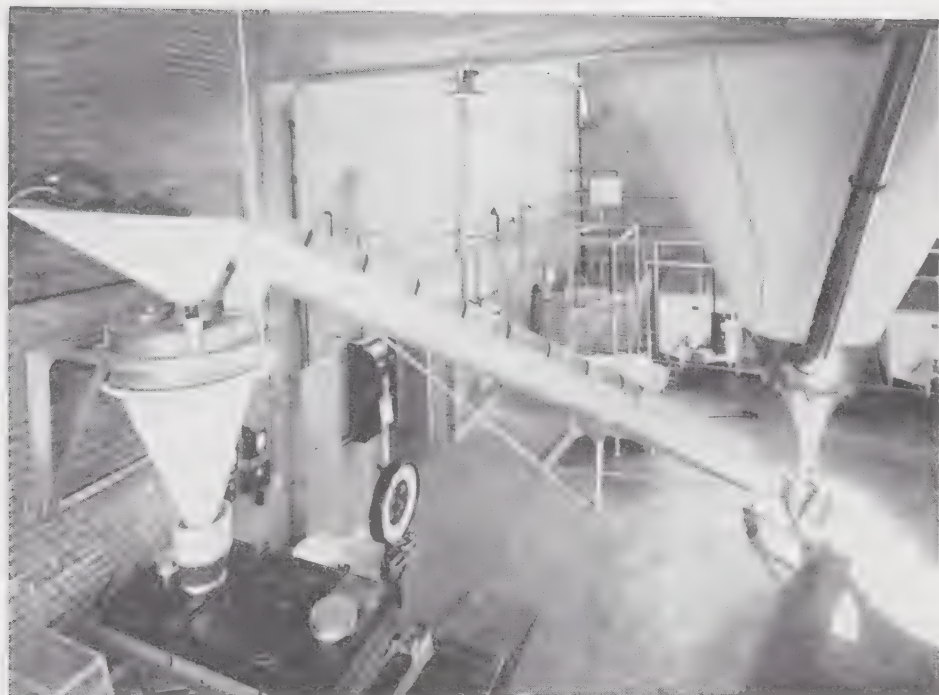
The cans of liquid eggs are frozen solid as quickly as possible in refrigerated rooms at -10° F or lower. An air blast is frequently used to hasten the process. Winter and Wrinkle¹⁰⁹ found that 30-pound cans of whole egg could be frozen to 0° F in 28 hours. Rapid freezing helps prevent sour cores in the cans.

Drying

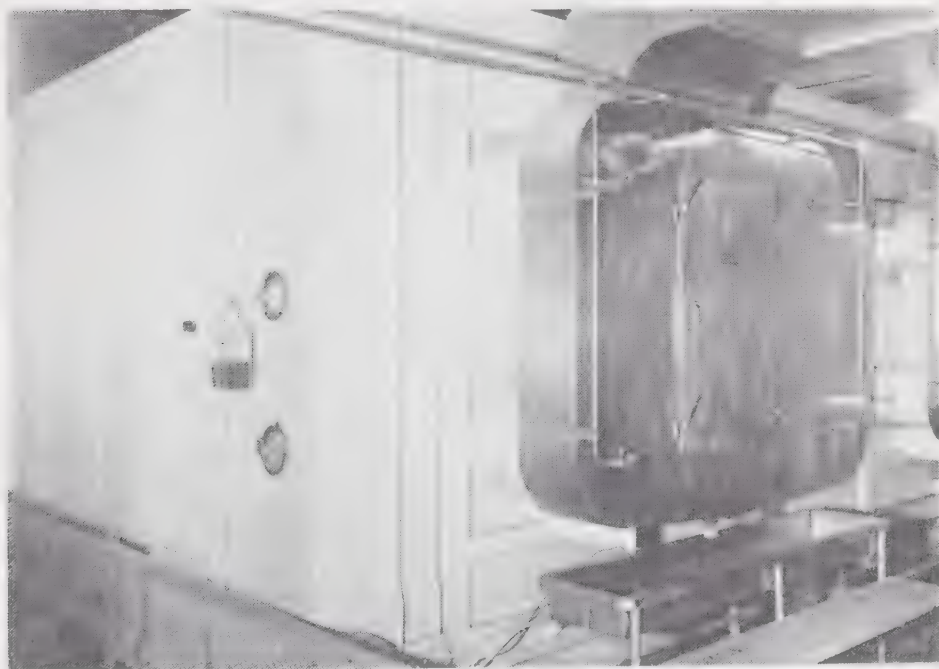
The most popular methods for drying eggs are the spray system for whole eggs and yolks and the pan method for albumen.

Spray method. Many of the spray whole-egg and yolk driers are milk driers slightly modified for egg drying; others are built along the same general plan. In the drying operation, the liquid whole-egg or yolk is fed into a high-pressure pump which delivers it to the spray nozzle under pressures ranging from 1,800 to 5,000 pounds per square inch, the pressure depending upon the type of drier. The inlet temperature of driers ranges from about 230° to 300° F (Fig. 37). A good drying operation obtains atomization under conditions that allow the particles to evaporate to about 3 to 5 per cent moisture content, and, at that critical point, to leave the area of high temperature and be removed from the drier.²⁷ Modern spray driers running continuously, produce about 6 to 10 tons of dry whole egg or yolk in 24 hours. Multistage drying is also used to lower the moisture content of the product to desirable levels.

Pan method. Freshly separated albumen is placed in large stainless steel tanks and allowed to undergo a bacterial fermentation.⁸² When the fermentation is complete, as judged by testing for the presence



A



B

Fig. 37. A, Cyclonic type of spray dryer for whole egg or yolk. (Courtesy Swift and Co., Chicago, Ill.) B, New type of powdered-albumen spray dryer. Desugarized albumen is pumped under high pressure and sprayed into the dryer; hot air is drawn around the spray nozzle and through the dryer. Most of the sprayed albumen is dried in the large drying chamber. The balance is collected where the air is drawn through cloth bags before being exhausted into the outside atmosphere. (Courtesy Seymour Foods, Inc., Topeka, Kan.)

of sugar and by pH measurements, the liquid is treated with lactic acid to arrest the fermentation and to clarify the albumen. After standing for about 24 hours, the clear liquid is drawn off, poured into shallow pans, and placed in the drying rooms (Fig. 38). The temperature in the drying rooms is about 114° to 118° F, and the albumen dries to a sheet of crystal or flake albumen. If the albumen remains in the drying room too long it will deteriorate; therefore, as soon as a definite rubbery stage is reached, the pans are moved from this room. A desugaring process used in the manufacture of dried albumen is important in maintaining its keeping quality.

Albumen is graded according to size of particle and packaged for shipment. Flake albumen is made up of large pieces or flakes. Granu-



Fig. 38. Inside of albumen drying room used for preparation of flake or crystal albumen. Note the albumen in the pans. (Courtesy Traim Egg Products Co., Kansas City, Mo.)

lar consists of pieces that are retained on a 30-mesh screen, and powdered is made up of ground albumen or that which passes through a 30-mesh screen.

PRODUCTS OF THE INDUSTRY

The principal frozen egg products are whole egg, albumen, plain yolk, salted yolk, sugared yolk, and yolk emulsions. Fortified dried whole egg contains an extra 25 per cent yolk, and quick whipping white is produced by milling before freezing, in such a way that it whips rapidly and has an excellent whipped volume. Salted yolks have 10 per cent salt added, and sugared yolks have 10 per cent sugar added. Sugar and salt are anti-coagulants that are added to overcome changes taking place during freezing which affect the physical and colloidal properties. If they are not added, the yolk has a tendency to become gummy or rubbery because of dehydration and coagulation of the lecithoprotein in the yolk. The principal egg solids products are whole eggs, yolk, whites, and fortified whole egg solids.⁸⁴

Major Uses ⁵⁷

Frozen and dried egg is preferred over shell egg and liquid egg by manufacturers. The essential character of the egg contents is not changed by drying or freezing. Eggs in the frozen or dried form are easier to handle, not fragile, less bulky, and the quality of a certain lot will be uniform throughout rather than dependent upon the varying character of each egg separately opened. The emulsification and leavening properties of the eggs are not lost by the freezing or drying.

Among the principal uses for dried egg are:

1. Mixtures in flour, either yolk, white, or proportions of each, for preparations of "mixes" for cakes, cookies, meringues, and the many other uses promoted by flour manufacturers and others.
2. Dried egg white is used by candy makers and for ice cream powders and "mixes."

Frozen whole egg is used for all kinds of baked goods in which whole shell eggs would otherwise be called for. Frozen yolk is sometimes prepared with an addition of 10 per cent sugar to improve the texture, or 5 per cent glycerine to help retain moisture and freshness in the end product.

For many of the uses of frozen or dried whole egg, white, or yolk, the users may substitute one product for the other, or change the

proportions of each, according to relative costs or special characters desired for the end product. New nutritional recommendations and changes in consumer desires are important contributors to the need for changes in manufacturing practices. Dark yolks, whether frozen or dried, are preferred by manufacturers of mayonnaise, noodles, and various other products because they provide more of the desired deep cream color in the product.

Users of frozen and dried egg have found that the reconstituting of the product for their particular needs requires special attention.

Other Uses

Eggs of low quality are used in dog foods. Egg products are used for many other purposes, including such things as a dressing for leather, seasoning for goldbeater's skin and drum heads, and as an adhesive for attaching gold lettering to leather. Technical albumen is used in certain photographic processes, in fixing colors in textile printing, and for fastening the cork inserts inside the metal caps on beverage bottles. Eggs and egg products used for these purposes are usually those not suitable for human consumption. In point of quantity, a larger outlet for such eggs is their incorporation in fertilizer and hog feed.⁹⁰

Egg shells have found a small economic outlet under certain conditions.¹⁰ Before the accumulation and drying of shells can be profitable, relatively large quantities of low cost shells need to be readily available, and the final product must be in a price position to compete with other sources of calcium, the principal chemical element in egg shells.

PACKAGING AND PACKAGES

Frozen eggs are packed in metal or fiber cans holding 10, 30, or 60 pounds, 30 pounds being the most popular. The 10- and 30-pound packs are used in domestic trade, whereas the 30- and 60-pound packs are used in the export trade. Specifications and standards⁹⁷ have been developed for these containers which give many details on the thickness of metal to be used, lacquering, and so on. All of these containers are for the wholesale trade. Some research has been done in recent years to develop a frozen egg pack for home use, but this work is still in an experimental stage. At least one attempt has been made to freeze individual eggs in plastic containers, each one about the size of an ice cube.

Egg solids are packed mostly in fiber drums for the wholesale trade.

Boxes, metal cans, and barrels ranging in net weight up to 200 pounds are sometimes used. Consumer packages vary from 5 ounces (the equivalent of 1 dozen eggs) to 3 pounds and are made of fiber or metal.⁹⁶ An essential requirement for all containers for egg solids is that they be moisture resistant. At times the packaging is done in an atmosphere of carbon dioxide and nitrogen to prevent flavor changes during storage.

GRADES, STANDARDS AND INSPECTION

Many of the large commercial users of egg meats and solids have their own purchase specifications. In 1939, the Federal Food and Drug Administration established standards of identity for egg products. During World War II, the U.S. Department of Agriculture purchased considerable quantities of egg solids on the basis of per cent dry solids, per cent fat, and solubility and palatability scores. The Armed Services have their specifications for these products.⁶³

The U.S. Department of Agriculture has been working for many years with the industry in providing inspection services concerning sanitary requirements and operating procedures in egg processing plants and certification on that basis. When plants manufacture and package egg products under the continuous supervision of a U.S. Department of Agriculture licensed inspector, the entire processing operation is checked and the "Regulations Governing the Grading and Inspection of Egg Products"^{94,99} apply. Usually, general or specific state laws and regulations apply to egg processing plants. A compilation for the North Central Region was made recently.

There is also a limited amount of inspection for condition of frozen eggs and egg solids in terminal markets. The inspection of frozen eggs is made by drilling the solidly frozen mass and examining the product for odor, appearance, and condition. The purpose is to determine the bacterial count and whether off-odors or other conditions are present which also might render the product unfit for food.

YIELDS AND CONVERSION FACTORS

In commercial plant operations, the amount of finished product obtained from a given quantity of raw material is of primary importance. This relationship is usually called "yield." If one plant can get a higher yield than another, the profits of the first plant will be higher,

with other factors held constant. Conversion factors are merely the mathematical ratios used to determine the amount of one kind of product that can be obtained from a given quantity of a related product. Conversion factors are prepared from yield relationships.

Through the years there has been an increase in the yield of liquid eggs obtained from a case of shell eggs, due to more efficient operations and the fact that breakers are now using full-sized market grades of eggs during the flush of the season. Yields vary seasonally, with the beginning and ending yields much lower when more dependence may be put on small or other off-grade eggs. Table 13 shows the yields and conversion factors for the various egg products.

Table 13. Average Weights for Shell Eggs, and Yields per Case of Liquid, Frozen, and Dried Eggs, 1909-1958

Year	Shell Eggs		Breaking Stock					
			Yield, Liquid or Frozen			Yield, Dried (Egg Solids)		
	Avg. Wgt. per Doz.	Avg. Wgt. per Case						
			Mixed Whole Egg	Albumen	Yolk	Mixed Whole Egg	Albu- men	Yolk
<i>Pounds</i>								
1909-15	1.50	45.0	35.0	...	...	...	...	...
1916-20	1.50	45.0	35.5	...	...	...	...	...
1921-25	1.50	45.0	36.0	...	...	...	...	...
1926-30	1.50	45.0	36.5	...	...	...	...	...
1931-33	1.50	45.0	37.0	...	...	...	...	...
1934-36	1.50	45.0	37.5	...	...	...	...	...
1937-46	1.50	45.0	37.5	...	...	...	...	...
1947	1.51	45.3	37.5	...	...	...	...	...
1948	1.52	45.6	37.5	...	...	...	...	...
1949	1.53	45.9	37.5	...	...	...	...	...
1950	1.54	46.2	37.5	...	...	...	...	...
1951	1.55	46.5	38.5	21.3	17.2	10.2	3.1	7.5
1952-56	1.56	46.8	38.5	21.3	17.2	10.2	3.1	7.5
1957	1.57	47.1	38.5	21.3	17.2	10.2	3.1	7.5
1958	1.57	47.1	39.5	...	...	10.8	...	...

Source: "Egg and Poultry Statistics through 1957, U.S.D.A., *AMS Statistical Bull.* 49, May 1959.

Questions

1. Visit a bakery, and find out what egg products they use. If possible, secure a list of the products in which they use eggs.
2. Visit a large egg farm, and learn how they market or use the cracks and leakers that are graded out of each day's production.
3. In what section of the country are most of the egg products produced? Why?
4. How does the season of the year enter into the egg products industry?
5. What are the main frozen egg products and the main egg solids products?
6. For what items other than food are egg products used?
7. How are egg products graded?
8. What yields can be expected per case of breaking stock and what factors influence the yield?

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Marketing Live Poultry

Historically, the marketing of live birds is the oldest form of poultry marketing and in some sections of the United States it is still carried on in the age-old way. During the last 25 years, this industry has been declining in importance and the trend will probably continue. However, the marketing of live poultry is still of sufficient importance to merit discussion.

BASIC PURPOSE

The major movement in the marketing of poultry in the live form is from farms to country assemblers, wholesale receivers, slaughterhouses, retail stores, and consumers. The basic purpose of this movement of live birds is to provide consumers with fresh-killed poultry at or near the point of purchase and often under certain religious customs and supervision. Immigrant and first generation Spanish and Italian speaking people often demand fresh-killed poultry because it was customary in their homeland, where modern slaughtering and refrigeration facilities were scarce or lacking entirely. However, Jewish people have provided the largest demand for live and fresh-killed poultry because of the requirements and rites of the Hebrew religion.

TRENDS IN THE INDUSTRY

In New York City receipts showed a consistent increase from 1900 to 1927, but since then they have been showing a fairly steady decline. A comparison of receipts of live and dressed poultry for recent years at four major markets is shown in Table 14. Not only have the receipts of live poultry declined, but the proportion of total receipts accounted for by dressed poultry has increased.⁷⁹

Many reasons have been given to explain these trends. Probably the most important one has been the ability of the dressed poultry industry to provide consumers with a wholesome and acceptable product, more convenient, and at lower cost than can be done with live

Table 14. Comparison of Receipts of Live and Dressed Poultry at the Four * Major Markets, 1944-1958

Year	Live Poultry Receipts †	Dressed Poultry Receipts	Total Poultry Receipts	Dressed as Per Cent of Total
Thousand Pounds			Per Cent	
1944	208,653	436,756	645,409	67.7
1945	164,567	504,891	669,458	75.4
1946	218,437	554,579	773,016	71.7
1947	203,112	488,330	691,442	70.6
1948	190,781	417,126	607,907	68.6
1949	184,336	486,947	671,283	72.5
1950	194,852	550,438	745,290	73.9
1951	176,723	605,582	782,305	77.4
1952	164,112	633,759	797,871	79.4
1953	137,926	583,554	721,480	80.9
1954	129,022	569,376	698,398	81.5
1955	111,923	613,731	725,654	84.6
1956	109,561	701,697	811,258	86.5
1957	99,671	711,329	811,000	87.7
1958	94,544	742,543	837,087	88.7

* New York, Chicago, Philadelphia, and Boston.

† The live poultry receipts were converted to a dressed weight basis for purposes of comparison.

Source: Computed from *Dairy and Poultry Market News Statistics*, U.S.D.A.

poultry. A study by Sprague, Sturges, and Radabaugh⁷⁹ demonstrated the latter point in 1937.

Although less strict observance of dietary laws by native-born Hebrews also has been advanced as a primary factor, the shift from live to dressed poultry has occurred over too short a span of years to result from changes of consumption patterns in Jewish families alone. Improved techniques and facilities for dressing and drawing poultry coupled with a rapid movement of the product through modernized marketing channels have gone a long way toward promoting the increased use of dressed poultry during recent years.

MARKETING CHANNELS FOR LIVE POULTRY

Country Assembly

Country assemblers or shippers of live poultry pick up at the farm or from country stores or buying stations. Trucks that pick up relatively small lots of live birds are usually used for bringing the poultry to the assembler's plant, garage, or other place of business.⁹⁸ There the birds are graded into lots as uniform as possible. Then they are loaded onto large trucks (Fig. 39) for over-the-road shipment to wholesale receivers or slaughterhouses in distant cities or at country points, where the slaughtering can usually be done at less cost. The operations performed by country shippers are: assembling of small lots into lots large enough for economic shipment to a consuming market; feeding the birds; grading the live birds by kind, quality, and weight;¹⁰⁰ and transportation to the market or slaughtering plant. This movement of live poultry is almost entirely by motor truck (a very small amount is still shipped by railway express). A large percentage of the live poultry was formerly transported to market in especially designed railroad cars. In 1930 there were 2,800 such cars. In 1950 there were 200, and by 1956 there were none in use. This rapid decline in the use of railroad equipment is due to less total live poultry business, and the fact that costs, shrinkage, and freight limit the distance that live poultry can be shipped profitably to market. Trucks are far more economical for the shorter hauls. Nearly all of

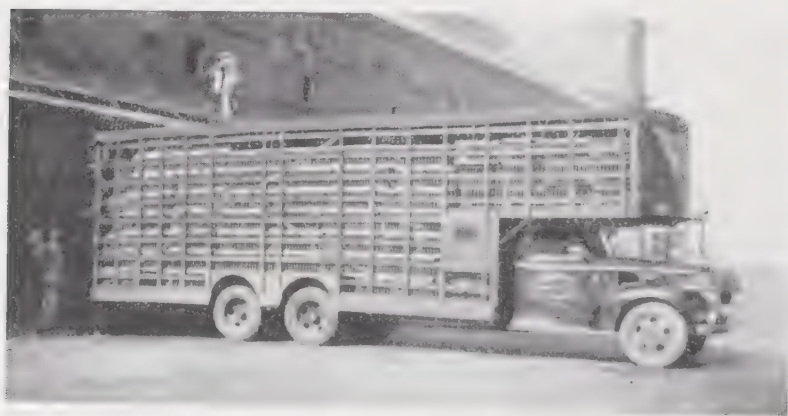


Fig. 39. Live poultry truck used for hauling poultry to the New York City Live Poultry Terminal from country collecting points. These trucks carry from 10,000 pounds to 12,000 pounds of live poultry. (Courtesy Urner-Barry Co., New York)

New York City's live poultry comes from New England and the Middle Atlantic States. A recent study⁶⁷ of live poultry dealers in New England showed that the total number of licensed live-poultry dealers declined 55 per cent from 1951 to 1957, although output of poultry meat increased by about one-third during the same span of time.

Twenty per cent of the 350 potential assemblers of live poultry in New England in 1957 hauled 88 per cent of the volume available from farms. These firms were large processing plants, contractors, and contract haulers. The remaining 12 per cent was hauled by buyers of live poultry, live-poultry stores, and small slaughterers.

Handling in the Markets

Country assemblers typically ship their live poultry to commission merchants and dealers in the markets. The wholesale receivers in turn sell to slaughterhouses that wish to purchase in less than truck-load lots.

Live poultry in New York City. As New York City is the largest terminal market for live poultry in the world, and the New York prices have an important influence on the prices paid at country points in nearby areas, a study of the handling of live poultry in this market is advisable.⁷⁹ The procedures in New York are not on the whole different from those in other sections of the United States, except for certain details made necessary by distribution complications which are confined to New York City. The New York City Live Poultry Terminal was built by the City of New York in 1942 at a cost of \$550,000. It is located in Long Island City and occupies 13 acres of land. It is operated by the City Department of Markets. The market until recently was self-supporting, its income being derived from rents, licenses, and weighing and inspection fees. It was built to provide a union terminal for the inspection and sale of all live poultry entering New York City. All live poultry commission merchants and dealers are licensed by the city.

The market is open from 6 A.M. to 3 P.M. Monday through Friday but extends the hours and opens on Saturday when the trade is very heavy, especially before holidays. Inspections will also be made on Sundays to accommodate slaughterers needing stock ready for Monday morning. The bulk of the shipments arrive in the early part of the week, usually before noon.

When a country shipper's truck (Fig. 39) arrives it is unloaded on one side of the truck platform at the stall of the commission merchant who is handling it, unless the owner chooses to leave it on the truck

awaiting a better market. Workers employed by the commission merchant remove the poultry from the baskets (the term for the small coops used by country dealers) in which they are shipped, each basket holding about 60 pounds, and place the birds in long coops which hold about 200 pounds. As the long coop is filled, it is weighed by a city weighmaster, who enters the amount on an invoice. The filled coops are stacked on the other side of the platform where the slaughterhouse buyers' trucks stand (Fig. 40). The buyer looks over the poultry, and when he has made a choice, an inspection is made by a city inspector, inspection labels are placed on all purchased coops, and the poultry is hauled away. An average truckload is 10,000 pounds.

At a special platform reserved for direct receivers only, truckloads are inspected and, if approved, are permitted to proceed to the receiver's slaughterhouse.

Through city field inspectors, under the supervision of the market director, close watch is maintained over the poultry trade in slaughterhouses and other points around the city. Since all live poultry is required to be inspected at the terminal, the field inspectors check constantly for illegal movements of live poultry into the city, for uninspected poultry at direct receivers' slaughterhouses, and for any other violations of the law covering live poultry.

Live poultry shipped to other cities generally reaches the consumer in a more direct manner. The poultry may be unloaded at the business place of the receiver or slaughterer, who sells it either at wholesale or from his own killing establishment. Thus, the cost of distribution may be lower.

The number of live poultry commission merchants is gradually declining in all markets. The commission is usually at a fixed rate, (in



Fig. 40. Slaughterhouse buyers' trucks being loaded at truck platform of the New York Live Poultry Market Terminal. (Courtesy Uner-Barry Co., New York.)

New York City now 2½ cents per pound) which sets up a cost that is not flexible enough to permit competitive innovations and special deals. From about a dozen commission merchants of a few years ago in the New York Live Poultry Terminal, the last reorganization brought the number down to six, of which four operate as Poultry Service, a federated organization, and two operate independently.

Sales

As a large proportion of the Jewish consumption of poultry occurs on Friday and Saturday, the greatest movement from wholesalers to slaughterers occurs on Tuesday and Wednesday. However, the highest prices are not necessarily on the days of the greatest movement.

Prices at the Terminal Market are a matter of negotiation between the owner (sometimes the truck driver) and the slaughterhouse buyers. Each morning, the carry-over from the previous day and new arrivals are posted on a bulletin board.

FEDERAL PACKERS AND STOCKYARD ACT

In addition to local regulations, dealers in such areas as may be designated by the Secretary of Agriculture must obtain federal licenses and operate under the same general type of federal supervision as that governing the marketing of other livestock. Administration of the act is under the Packers and Stockyards Division of the U.S. Department of Agriculture. This legislation covers marketing in a broad sense, including the receiving, buying, or selling (on a commission basis or otherwise), feeding, hauling, delivering, shipping, weighing, loading, and trucking, and provides for the establishment of rates and charges and other conditions incident to the proper and economical marketing of live poultry. Designated areas at present are, New York City, Boston, Philadelphia, Chicago, St. Louis, and Camden, Jersey City, and Newark, New Jersey. Usually the federal and local regulations are worked out so as to avoid duplication.

KOSHER POULTRY

Kosher poultry is poultry that meets the requirements of, and is killed in accordance with, the rites of the Hebrew dietary laws. To be kosher, a bird must have no evidence of broken bones, malformations, bruises, or disease, either external or internal. There can be

no foreign material such as pieces of metal or wood in the throat or intestines. A bird which does not meet these requirements is tref, but it may be sold through nonkosher channels, if it is edible in accordance with health regulations.

The kosher dietary regulations were set up under the ancient Talmud of the Hebrew people during times when they were probably essential for purposes of sanitation and health. They became part of the traditional laws of the Jewish faith. There is some variation in the interpretation of Hebrew dietary laws referring to the preparation of poultry. Some Jewish housewives go to a slaughterhouse, select a live bird, have it killed and picked, and take it home still warm. Recent developments whereby poultry can be killed and drawn in an orthodox manner in country slaughter plants, and shipped chilled and frozen as kosher (meeting the Hebrew dietary rules), are likely to expand. Considerable quantities of kosher poultry are now shipped to New York City from slaughter plants in Connecticut, Pennsylvania, and other states.

The increasing volume of these dressed birds having been kosher killed in the country, is bypassing the previous necessity for the expensive practices of the old line commission merchant-city slaughterhouse-retail store operation. The business of the direct receiving wholesale slaughterhouse operators is in some instances integrated with retail outlets in efforts to meet the lower costs of country slaughterhouses.

Kosher Killing

Kosher killing is performed by a rabbi or a duly authorized assistant, a shohet. The bird is grasped breast up and held under the left arm, with the head held throat up in the left hand. With a long, sharp-bladed knife, the throat is cut with one stroke. It is essential that the knife be kept clean, with an absolutely smooth, sharp cutting edge, which must be tested with a fingernail after each bird is killed. If the blade is at all rough, or if the operation has not been performed with one straight cut, the bird becomes tref. The jugular vein must be completely severed. The trachea and esophagus are pushed out through the cut to be sure they are also completely severed.

When killed, the birds are usually thrown into a barrel or metal can, often without a bottom, where they complete their bleeding during their involuntary convulsions. When the can is filled, it is tipped over, or the bottomless barrel is removed. Finally the birds are sorted either for the customer or for plucking, so that they may be sold with the feathers removed.

Hebrew Holiday Demands

In Table 15 are listed the Hebrew holidays and the kinds of poultry desired. The two most important holidays requiring extra supplies are

Table 15. Hebrew Holidays, 1958-1959 to 1966-1967
Jewish Years, 5719 to 5727 *

Year	Rosh Hashana (New Year)	Yom Kippur (Day of Atonement)	Sukkoth (Feast of Tabernacles)	
			First Day	Eighth Day
1958-59	Sept. 15, 1958	Sept. 24, 1958	Sept. 29, 1958	Oct. 6, 1958
1959-60	Oct. 3, 1959	Oct. 12, 1959	Oct. 17, 1959	Oct. 24, 1959
1960-61	Sept. 22, 1960	Oct. 1, 1960	Oct. 6, 1960	Oct. 13, 1960
1961-62	Sept. 11, 1961	Sept. 20, 1961	Sept. 25, 1961	Oct. 2, 1961
1962-63	Sept. 29, 1962	Oct. 8, 1962	Oct. 13, 1962	Oct. 20, 1962
1963-64	Sept. 19, 1963	Sept. 28, 1963	Oct. 3, 1963	Oct. 10, 1963
1964-65	Sept. 7, 1964	Sept. 16, 1964	Sept. 21, 1964	Sept. 28, 1964
1965-66	Sept. 27, 1965	Oct. 6, 1965	Oct. 11, 1965	Oct. 18, 1965
1966-67	Sept. 15, 1966	Sept. 24, 1966	Sept. 29, 1966	Oct. 6, 1966
Poul- try de- manded	Live fat fowl, hen turkeys, ducks, geese, and squabs	Fancy quality of chicken and fowl	Live ducks, fowl, fat geese, squabs, and hen turkeys	Fancy quality of all kinds
Year	Hanukkah (Feast of the Dedication)	Purim (Feast of Lots)	Pesach (Passover)	
			First Day	Eighth Day
1958-59	Dec. 7, 1958	March 24, 1959	Apr. 23, 1959	Apr. 30, 1959
1959-60	Dec. 26, 1959	March 13, 1960	Apr. 12, 1960	Apr. 19, 1960
1960-61	Dec. 14, 1960	March 1, 1961	Apr. 1, 1961	Apr. 8, 1961
1961-62	Dec. 3, 1961	March 20, 1962	Apr. 19, 1962	Apr. 26, 1962
1962-63	Dec. 22, 1962	March 10, 1963	Apr. 9, 1963	Apr. 16, 1963
1963-64	Dec. 11, 1963	Feb. 27, 1964	Mar. 28, 1964	Apr. 5, 1964
1964-65	Nov. 30, 1964	March 18, 1965	Apr. 17, 1965	Apr. 24, 1965
1965-66	Dec. 19, 1965	March 6, 1966	Apr. 5, 1966	Apr. 12, 1966
1966-67	Dec. 8, 1966	March 26, 1967	Apr. 25, 1967	May 2, 1967
Poul- try de- manded	Fancy quality of all kinds	Fancy fowl and hen turkeys	Fancy fowl, capons, hen turkeys, and ducks	Fancy quality of all kinds

* All Jewish Holidays begin at sunset on the day previous to that shown in this table. If Saturday, substitute the Sunday immediately following.

the Passover in the spring and the Day of Atonement in the fall. The demand for live poultry is also large at Thanksgiving and Christmas.

KINDS OF POULTRY

Although a large variety of terms is used in different markets to meet local needs and conditions, the kinds of poultry commonly handled in both live and dressed poultry markets are chickens, turkeys, ducks, geese, guineas, and pigeons.

Chickens

Broilers or fryers. These young chickens (usually under 16 weeks of age), of either sex, are tender-meated with soft, pliable, smooth-textured skin and flexible breastbone cartilage.

Roasters. Roasters are young chickens (usually under 8 months of age), of either sex, that are tender-meated with soft, pliable, smooth-textured skin and breastbone cartilage that is somewhat less flexible than that of broilers or fryers.

Pullets. Pullets are female chickens up to about 10 months of age, of definitely softer meat than males of the same age.

Capons. These unsexed male chickens (usually around 10 months of age) are tender-meated with soft, pliable, smooth-textured skin.

Stags. Stags are male chickens (usually under 10 months of age) with coarse skin, somewhat toughened and darkened flesh, and considerable hardening of the breastbone cartilage. Stags show a condition of fleshing and a degree of maturity intermediate between that of roasters and cocks, or old roasters.

Hens, stewing chickens, or fowl. These are mature female chickens (usually more than 10 months old) with meat less tender than that of roasters and nonflexible breastbone.

Cocks or old roasters. Cocks are mature male chickens with coarse skin, toughened and darkened meat; and hardened breastbone.

Turkeys

Fryers or roasters. These young immature turkeys (usually under 16 weeks of age), of either sex, are tender-meated with soft, pliable, smooth-textured skin and flexible breastbone cartilage.

Young hen turkeys. Young female turkeys (usually under 8 months of age) are tender-meated with soft, pliable, smooth-textured skin and breastbone cartilage that is somewhat less flexible than in turkey fryers or roasters.

Young tom turkeys. Young male turkeys (usually under 8 months of age) are tender-meated with soft, pliable, smooth-textured skin and breastbone cartilage that is somewhat less flexible than in turkey fryers or roasters.

Hen turkeys. Hen turkeys are fully matured female turkeys (usually over 10 months of age) that are less tender-meated than young hen turkeys, have a hardened breastbone, and may have coarse-textured skin and patchy areas of surface fat.

Tom turkeys. These mature male turkeys (usually over 10 months of age) have coarse skin, toughened flesh, and hardened breastbone.

Breeder hens. Breeder hens are mature females which have been used as breeders during the early spring and are usually shipped to market as soon as the breeding season is over. A considerable proportion of culls are often found among such birds.

Ducks

Broiler ducklings or fryer ducklings. These young ducks (usually under 8 weeks of age) of either sex are tender-meated and have a soft bill and soft windpipe.

Roaster ducklings. These young ducks (usually under 16 weeks of age) of either sex are tender-meated, have a bill that is not completely hardened, and have a windpipe that is easily dented.

Ducks and old ducks. Ducks (usually over 6 months of age) of either sex have toughened flesh, hardened bill, and hardened windpipe.

Geese

Young geese. Young geese may be of either sex, are tender-meated, and have a windpipe that is easily dented.

Geese or old geese. These may be of either sex and have toughened flesh and hardened windpipe.

Fattened geese. Geese especially fed to produce surplus fat prized by many for certain culinary purposes are called fattened geese.

Guineas

Young guineas. Young guineas may be of either sex and are tender-meated.

Guineas or old guineas. These may be of either sex and have toughened flesh.

Pigeons

Squabs. Young, immature pigeons of either sex are especially tender-meated.

Pigeons. Matured pigeons of either sex have coarse skin and toughened flesh.

STANDARDS OF QUALITY AND GRADES FOR LIVE POULTRY

Standards of quality that include such things as health and vigor, feathering, conformation, fleshing, fat covering, and defects are the basis of the grades for live poultry. In various markets the trade often adopts terms which fit the types of birds coming to the market during various seasons. Among these are such well known terms as Extra Fancy, Fancy Quality, Fancy, Average, Fair, Poor, Fat, and the like. Other terms often used are:

Fancy large. This term is used when such birds sell at a premium price.

Heavy. Heavy is usually used when the demand is for small birds and the heavies have to be offered at lower prices.

Scabby. This is sometimes applied to fowl with rough hardened shanks and skin, not diseased but usually indicating age and poor quality.

New England, southern, western, etc. These terms, which indicate area of origin may be an indication of superior quality or poor quality, according to what sort of poultry is coming from the designated area at that time.

Rocks. This term designates birds of the Plymouth Rock type, which are ordinarily popular meat birds.

Crosses. Crosses are any of the many crossbred chickens. Crossbreeding is usually a favorable factor.

Black. This is usually used for fowl of the dark-colored varieties, combining favorable heavy weight with unfavorable dark pin feathers.

Colored. The heavier, meat type birds.

White. Leghorns which are not ordinarily liked for meat purposes. This can be a favorable description when white crosses or other good types of white birds are coming to the market.

United States Department of Agriculture Standards of Quality for Live Poultry on an Individual Bird Basis

Under the U.S. Department of Agriculture standards, individual birds are judged according to the indicated factors and then classified as Grade A or No. 1 Quality, Grade B or No. 2 Quality, and Grade C or No. 3 Quality. Birds that fall below the requirements for Grade C are called "rejects" (Table 16).

Table 16. Standards of Quality for Live Poultry on an Individual Bird Basis (Minimum Requirements and Maximum Defects Permitted) *

Factor	A or No. 1 Quality	B or No. 2 Quality	C or No. 3 Quality
Health and Vigor	Alert, bright eyes, healthy, vigorous	Good health and vigor	Lacking in vigor
Feathering	Well covered with feathers showing luster or sheen Slight scattering of pin feathers	Fairly well covered with feathers Moderate number of pin feathers	Complete lack of plumage feathers on back Large number of pin feathers
Conformation	Normal	Practically normal	Abnormal
Breast Bone	Slight curve, 1/8" dent (chickens), 1/4" dent (turkeys)	Slightly crooked	Crooked
Back	Normal (except slight curve)	Moderately crooked	Crooked or hunched back
Legs and Wings	Normal	Slightly misshapen	Misshapen
Fleshing	Well fleshed, moderately broad and long breast	Fairly well fleshed	Poorly developed, narrow breast, thin covering of flesh
Fat Covering	Well covered, some fat under skin over entire carcass Chicken fryers, turkey fryers, and young toms only moderate covering No excess abdominal fat	Enough fat on breast and legs to prevent a distinct appearance of flesh thru skin. Hens or fowl may have excessive abdominal fat	Lacking in fat covering on back and thighs, small amount in feather tracks
Defects	Slight	Moderate	Serious
Tears and broken bones	Free	Free	Free
Bruises, scratches and callouses	Slight skin bruises scratches and callouses	Moderate (except only slight flesh bruises)	Unlimited to extent; no part unfit for food
Shanks	Slightly scaly	Moderately scaly	Seriously scaly

* Standards effective March 1, 1955. Adapted from U.S.D.A.

Any lot of live poultry may be designated U.S. Grade A or U.S. No. 1, if at least 90 per cent, by count, of the birds are A or No. 1 Quality and the remainder are of B or No. 2 Quality.⁹⁸ For a lot to be designated Grade B or No. 2, 90 per cent of the birds may be at least B or No. 2 Quality and the remainder may be C or No. 3 Quality.

Since the standards of quality and the grade requirements are subject to change, it is recommended that the current specifications be obtained by those who are using the standards for grading for market. Some state standards and grades are somewhat different than the federal, and some live poultry buyers use their own standards.

Questions

1. What has been the trend in the receipts of live and dressed poultry at New York, Chicago, Philadelphia, and Boston from 1944 to 1956?
2. A broiler-grower markets the broilers, but what classes of birds are sold from his flock at the retail level?
3. What classes of turkeys are most likely to be sold at Thanksgiving and Christmas?
4. In judging live birds for quality what are the major factors to be considered?
5. Visit a live poultry auction or terminal, and observe how the buyers select the live poultry. What factors do they use?
6. Go to a turkey grower, and find out what per cent of his flock are actually No. 1's at market time.
7. Observe a flock of fowl at the end of the laying period or at a live poultry terminal, and estimate the percentage in each of three U.S.D.A. grades.
8. Secure some data from one or more of the broiler tests, and indicate the percentage in each of the top grades.
9. How can the percentage of birds grading No. 1 be increased?
10. What are some of the main reasons for Grade C birds?

Supplementary Reading

Reference 36 in the Bibliography.

Processing Poultry

IMPORTANCE OF PROCESSING OPERATIONS

The processing of poultry, including killing, dressing, and eviscerating has become a highly commercialized operation. Although farmers kill and process some of the poultry they sell, a high percentage is killed and processed after leaving the farm. A study of more than 3,000 homemakers in various parts of the United States, showed that 87 per cent of the broilers and fryers were purchased in retail stores, 5 per cent were purchased from farmers, and 7 per cent were not bought but were raised by the homemakers.¹⁰⁸ Probably a similar pattern would be apparent for other kinds of poultry if the information were available.

During 1955, commercial poultry killing plants accounted for 75 per cent of the poultry sold from farms.²⁰ These plants killed at least 30,000 pounds live weight per week on the average while in operation. During 1956 the percentage rose to 81 and included approximately 690 plants which averaged 118,000 pounds per week with a range from 30,000 to more than 1,000,000 pounds per week. Small volume plants average 4,400 pounds with a range of less than 100 to 30,000 pounds per week. According to information gathered for the 1954 *Census of Manufacturers*, from 1308 poultry processing plants, the value added by manufacture was \$206 million.¹⁰⁴

Only a short 20 or 25 years ago the main source of poultry meat was the old hens that had outlived their usefulness as egg producers, and the male chickens from flock replacement stock. The major source now is from the commercially produced broilers, fryers, turkeys, and ducks. In some localities, owing to the recent development of strain types especially adapted to the production of fine quality meat, any lower quality of poultry meat is neglected in the markets. In such areas the male baby chicks from specialized egg-producing strains are often destroyed, and the 18-month or older laying hens of egg-producing strains are of only nominal value.

POULTRY PRODUCTS INSPECTION ACT OF 1957

Congress enacted legislation on August 28, 1957, which required that by January 1, 1959, all slaughtered poultry intended for human food which moves in interstate or foreign commerce is subject to the regulations of the U.S. Department of Agriculture in connection with its administration of the Poultry Products Inspection Act. Dressed poultry may not be moved in interstate commerce, except from one official establishment to another official establishment for further processing as ready-to-cook poultry or as poultry products. Poultry inspection procedures include: (1) supervision of the sanitation of plants; (2) ante mortem inspection as deemed necessary; (3) post mortem inspection of poultry during the time of evisceration to insure that the product is wholesome; (4) supervision of further processing of poultry, such as canning and preparing frozen poultry pies; (5) supervision of marking and labeling of poultry and poultry products; (6) disposal of condemned, unwholesome carcasses and unfit products.

Poultry and poultry products eligible for movement in interstate commerce are identified by official marks (Fig. 41).

PLANT LOCATION

Poultry processing plants are located in every state and in almost all populated places. The concentration of large plants in the areas of commercial production is readily apparent in Fig. 42.



A



B

Fig. 41. A, The federal inspection mark for poultry, permitting interstate shipment. B, The federal mark indicating quality; Grade A, B, or C. (U.S.D.A.)

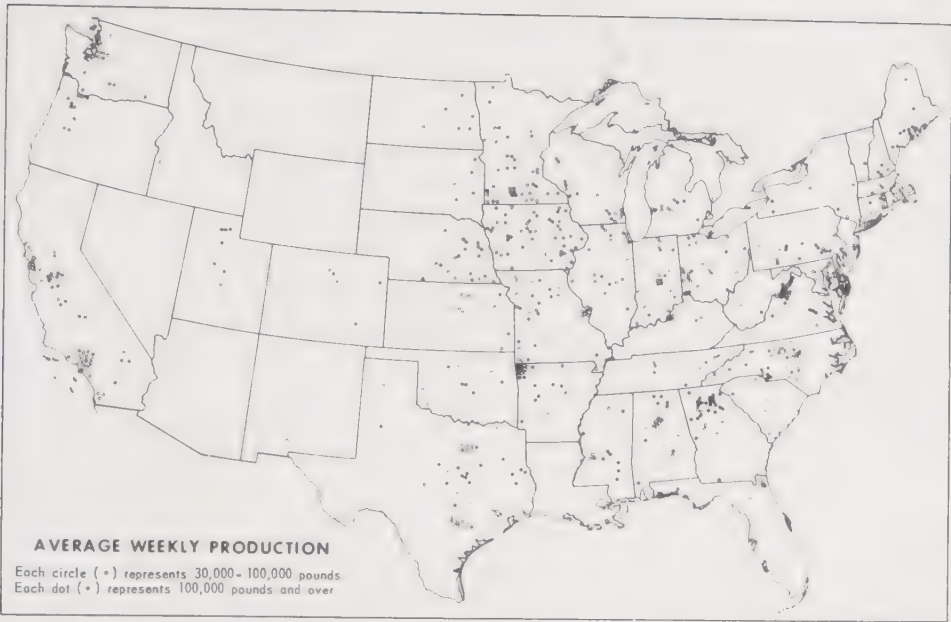


Fig. 42. Commercial poultry slaughtering plants, January 1956. Average weekly production: each circle (○) represents 30,000-100,000 pounds. Each dot (•) represents 100,000 pounds and over. (U.S.D.A. AMS.)

PRODUCTS OF THE INDUSTRY

A generation ago live poultry made up an important percentage of the poultry moving through marketing channels to retail outlets. More recently, dressed poultry assumed a major role and in recent years ready-to-cook poultry has come into prominence. The major portion of the products of poultry processing plants is now ready-to-cook poultry. A recent study³⁹ showed that 87 per cent of broilers and other young chickens, 82 per cent of the mature chickens, 95 per cent of the turkeys, 65 per cent of the ducks and geese and 88 per cent of all poultry were prepared in ready-to-cook form. It also showed that only 29 per cent was frozen, the balance being sold as fresh chilled. The production of canned, smoked, or otherwise prepared special products is discussed in Chapter 10.

SEASONALITY OF PROCESSING

Seasonality of poultry killing in commercial plants varies with the kind of poultry (Table 17). November is the month of peak killing for turkeys and geese, October is the peak month for hens and cocks,

and July is the peak month for ducks. Young chickens, which are mainly broilers and fryers, do not reveal a distinct seasonal pattern of killing, but rather are killed in about equal quantities each month. The seasonality of processing is important in evaluating the need for storage of the product and in meeting consumer's demands, which may be in a different seasonal pattern.

PROCESSING POULTRY

Prior to the plant operations of processing, the live birds must be procured and moved to the plant.

Procurement

In areas of general farm flocks it has been common practice to accumulate quantities of live birds for one or two days of plant operating time through purchases from country stores, rolling stores, and buying stations. Owing to the trend to larger production operations on the farms, the older method has been replaced for the most part in recent years by direct procurement of truckload lots of poultry from producers. For this purpose the producer or the processing plant employs large, especially built trucks equipped with fixed or movable cages, or flat-bed trucks with poultry coops.

Live birds normally lose weight between the farm and processing plant. The amount of weight loss varies with the kind and age of poultry, length of time in transit, temperature and humidity, and many other factors. Weight losses up to 3 per cent are common and may even go higher under unfavorable circumstances. In the trade they are usually referred to as "road shrink." Someone must bear the cost of this weight loss and a variety of methods have been tried to minimize it. Feeding the live birds while en route to their destination was a common practice when they were hauled long distance. Also, at one time, the live birds were fed at the processing plant for a number of days prior to killing to regain the road shrink and to gain additional weight. The most common practice at present is to move the birds quickly and over short distances from the farm to the point of slaughter.

Holding and Feeding Room

The purpose of this room is for receiving and holding live birds prior to killing (Fig. 43). When the main source of poultry meat was from farm flocks the birds were usually lean, and profitable feeding

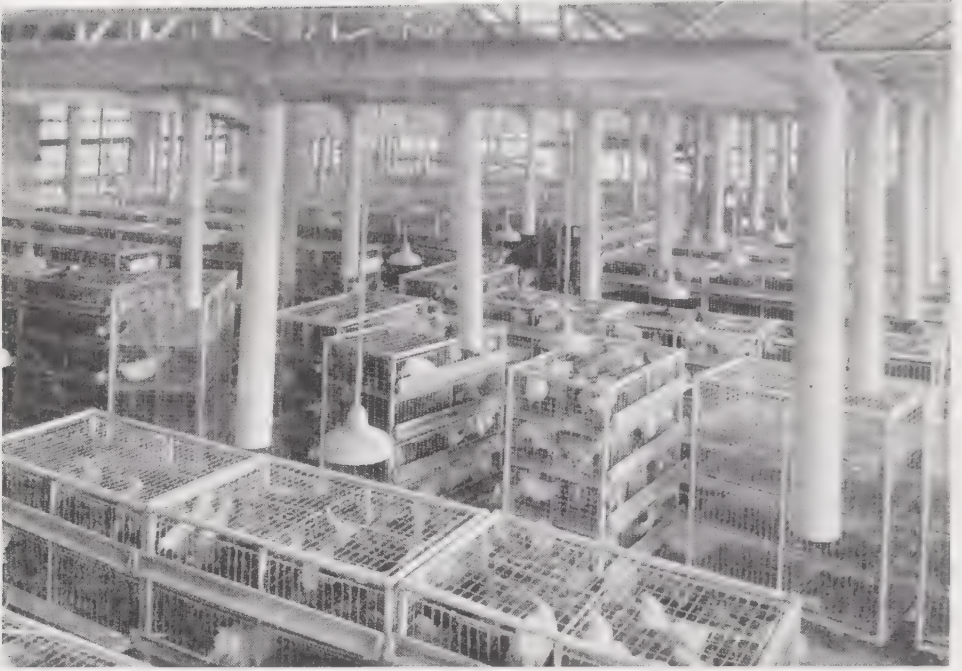


Fig. 43. Rooms with some degree of summer and winter air conditioning serve as a reservoir of live poultry to assure steady operation of the processing facilities. Batteries are often used for holding the birds from the time they arrive at the receiving dock until they are moved to the killing room.

gains could be achieved in the feeding room. However, the main source of poultry meat is now from commercially produced fryers and turkeys which are already well fleshed and soft meated, and profitable weight gains in feeding stations are very unlikely. Most of the large processing plants now attempt to schedule the arrival of the trucks as closely as possible to the processing operations.

Some of the large plants have feeding station operations, but their purpose is mainly to provide a steady flow of live birds to the processing line. In such cases the feeding station serves the function of a reservoir or an emergency holding place in case of plant breakdowns and the like. Feeding is done only as the condition of the birds or required time for holding dictates.

Killing Methods

Preparation for killing consists of bringing the live birds in batteries or coops from the truck or holding area to the killing line or point of slaughter. In line operations the birds are hung by their feet in shackles just prior to the place where the killing is done. In some

plants the birds are stunned by an electric shock just before killing, so that the muscles are relaxed and feather removal is made easier. In duck slaughtering in some plants, the birds are stunned by a blow on the head. Immobilization by carbon dioxide gas has been tried experimentally.¹⁸ When hand methods are used, the brain of the bird may be pierced through the roof of the mouth. A slight twist of the knife destroys the nerve center controlling the feathers and they are loosened for easy removal.

Proper bleeding is important in marketing high quality poultry. Poor bleeding is a direct cause of poor keeping quality, the development of undesirable flavors, and an unappetizing appearance of the carcass. Improperly bled birds may be detected by blood showing in the capillaries on the breast and veins on the neck, shoulders, and wings. Spots of blood may also show in the feather follicles and over the hips and thighs. Sometimes the entire appearance of the bird may be reddish and continue to deepen in color. In fresh dressed poultry poor bleeding may not be so apparent as in birds that have been chilled or frozen and thawed. When birds are carried in freezers for a considerable time, poor bleeding will show in discoloration of the bones and skin.

For proper bleeding, the bird's head is held in the left hand and the cutting edge of the knife is placed on the outside of the bird's neck just behind and below the left ear lobe. With downward pressure the knife is pulled forward for a short distance behind the jaw bone and then the head is rolled slightly with the left hand. A single, clean stroke is desirable because several cuts may induce clotting and prevent free bleeding. The blood should gush freely when the cut is properly made. The importance of proper killing and bleeding cannot be overemphasized, because all the efforts of production and marketing can be seriously jeopardized if it is not done well. In large plants the blood is collected in a bleeding trough for accumulation as tankage.

Feather Removal

Dry picking. This method has been largely displaced by modern methods of various degrees of scalding, lending themselves to automation in the processing plant. For dry picking the feathers should be loosened by proper stunning as already described.

Skinning. Some consumers prefer poultry that has the skin removed. This operation is not widely employed, but when it is, the feathers, of course, are removed in the process.

Scalding. In scalding operations the birds are dipped into or sprayed with water at controlled temperature and for a controlled time. The purpose of scalding is to facilitate feather removal and to improve the appearance of the skin.

HARD-SCALDING. The temperature of the water is 160° to 180° F, with the birds being submerged 30 to 60 seconds. The time of immersion varies with the water temperature but should be only long enough so that the feathers can be pulled out easily. At these temperatures the muscles in the feather follicles are cooked so that they loosen their grip on the feathers. Hard-scalding makes rapid picking possible but also destroys the protective covering of the skin; bacteria may thus enter and seriously impair the keeping quality of the bird. Combining hard-scalding with water cooling is not desirable, for some of the proteins in the flesh are dissolved and the flavor affected. Unless the operation is skillfully done, the outer protective skin is broken so that the bird appears blotchy when it is dried out. Because of these disadvantages, hard-scalded poultry is rapidly disappearing.

SEMI-SCALDING. The temperature of the water in this operation is 123° to 130° F, with the most common temperature 128° F. The length of time for immersion varies with the kind and age of poultry from 30 to 75 seconds, but generally one minute will produce good results. Under these conditions complete and easy feather removal is usually possible without removal of the epidermal skin layer. The objective is to obtain birds that retain their original skin color and "bloom." Such birds usually have more eye appeal in retail stores and have a longer shelf life than birds that have been hard-scalded. This kind of scalding, which is also called "soft-scalding" or "slack-scalding," was developed about 1925 in a poultry packing plant in Indiana. It was found that the feathers loosened, yet the finished product had a better appearance than that of a hard-scalded bird. This method softens and spreads the fat beneath the skin, thus improving the appearance of the bird.

Because of the necessity for accurate temperature and time control, this method has encouraged the development of automatic machinery for the dressing of poultry. In commercial plants the birds are hung on shackles that are attached to an overhead conveyor, are killed, and are then allowed to bleed for approximately 1 minute before entering the scalding tank, through which they pass 30 seconds to 1½ minutes. The scalding tank generally consists of a long, narrow vat filled with water. The temperature of the water is thermostatically controlled. It should be equipped with continuous overflow. New water should

be continuously added, not only to replace that which is carried out by the birds passing through, but also to overflow and keep the water clean. The water is thoroughly circulated in the tank by a pump so that the feathers of the birds are ruffled and the water reaches all portions of the skin. The spray-type scalding is likely to keep the water cleaner than the tank type (Fig. 44).

SUB-SCALDING. For this method the water temperature is held at 138° to 140° F, and the birds are submerged for 30 to 75 seconds. At this higher temperature the epidermal skin layer is removed. The birds have a pink, glossy appearance and are sticky to the touch after they have dried. They tend to darken in color when exposed to the air for long periods of time. Despite these disadvantages sub-scalding is being used for poultry that is tightly wrapped with a moisture-resistant covering prior to freezing. It is also used for poultry that is packed in trays, tightly wrapped, and moved into retail stores for immediate sale. The popularity of this method is due to the fact that

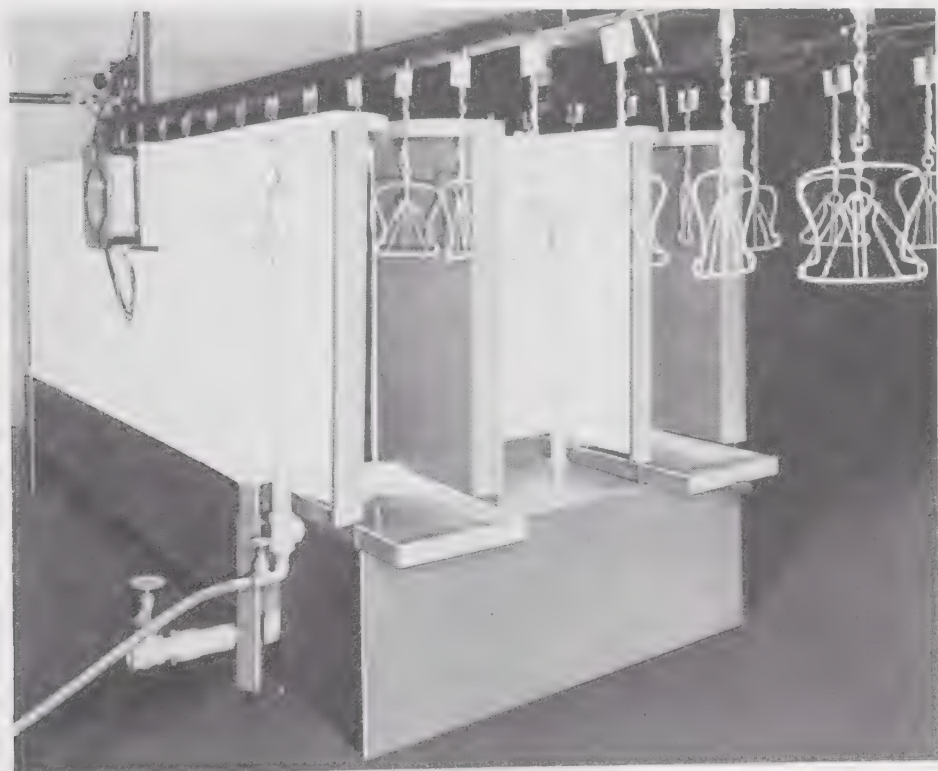


Fig. 44. The hydro-spray scalding. In this scalding the birds pass through a water spray rather than a tank of water. (Courtesy Gordon Johnson Co., Kansas City, Mo.)

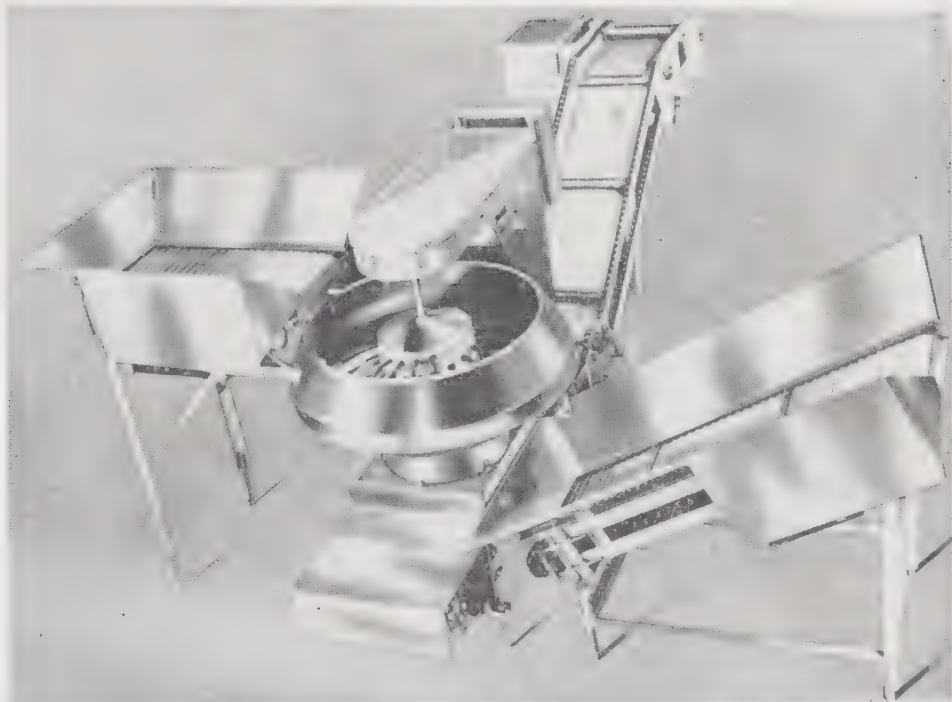
feather removal is easier, less costly, and more complete than when semi-scalding is used.

COMBINATION SCALDING METHODS. By combining methods of scalding, feather removal on all parts of the bird may often be facilitated. Neck and hock feathers are more difficult to remove than most of the other feathers, and for these parts an additional scalding is sometimes used. A shallow trough is used for this operation with a water temperature of 140° to 145° F for chickens and 10 to 15° higher for turkeys. This additional scalding of the necks and hocks permits feather removal by machines, and thereby reduces the amount of hand-pinning labor needed.

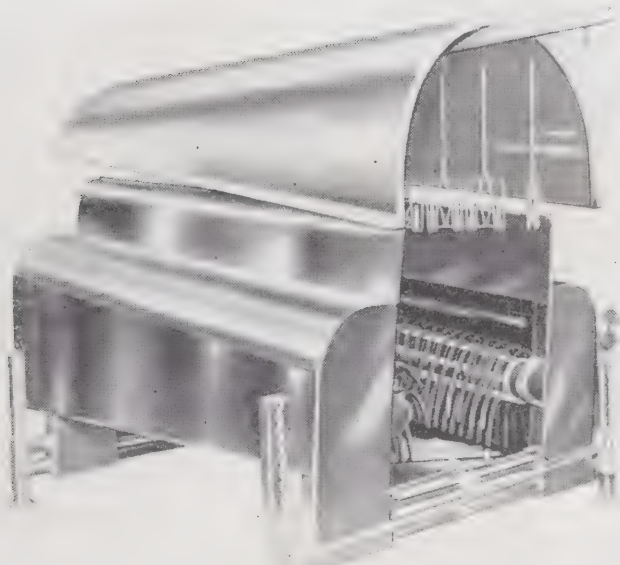
Mechanical picking. Various methods of machine picking are especially adapted to defeathering machine-scalded birds. In commercial poultry processing plants where the birds come from the scalding, they are hung in shackles which are attached to an overhead conveyor and then pass through one or more automatic pickers (Fig. 45). These machines usually consist of revolving drums with numerous rubber fingers, which flail the birds and remove most of the feathers. Sometimes additional machines are placed along the line traveled by the birds so that operators can hold the birds against single or double revolving drums and remove more of the feathers as needed. One equipment manufacturer recommends three finishing units—neck finisher, wing finisher, and leg or hock finisher. These units have variations in the angles of the revolving drums and placement of the rubber fingers.

Another type of equipment for defeathering chickens and turkeys that is rapidly gaining acceptance among poultry processors, large and small, consists of a drum or series of drum-like devices into which poultry is placed after scalding. The drum or cylinder is equipped both on a core and on the rotating wall, with rubber fingers. Scalded poultry in the drum is thus submitted to a scrubbing action that rapidly defeathers it. After a prescribed number of drum rotations the birds are removed for finished pinning. The loading and unloading of the drum may be done by hand in the smaller units or is done mechanically if the operation is large enough to warrant overhead conveying equipment.

After removal of most of the feathers by the automatic machines, the birds pass through the pinning area. Here the pinners remove the remaining pin feathers by using dull short-bladed pinning knives. The pinners walk with the moving line and handle several birds each trip. In some plants, after completing a bird the pinners sometimes affix metal or plastic discs, bearing numbers which are assigned to each



A



B

Fig. 45. A, Barker single cyclomation picking machine with loading, dressed bird and feather conveyors. (Courtesy Barker Poultry Equipment Co., Ottumwa, Iowa.) B, Multi-matic picker with loading and dressed bird conveyors. (Courtesy Gordon Johnson Co., Kansas City, Mo.)

pinner. This system enables the checker to give credit to each pinner and to identify pinners who are not doing a good job.

WAX PICKING. If a rough picked bird is coated with hot wax, the remaining feathers and pin feathers become so imbedded in it that, when the wax is cooled and removed, the feathers, pin feathers, hairs, and any other foreign material are removed cleanly from the skin by the wax.³³ This method has been used in conjunction with semi-scalding. From the wax dip tank the birds pass to the stripping table where the wax is broken and removed in large pieces or flakes (Fig. 46). The skin of the birds is left with a natural, moist, waxy bloom.

With the improvements in mechanical picking equipment that have been made, the wax picking method of defeathering chickens and turkeys has been discontinued. Only the commercial duck and goose processing plants use the wax method at present.



Fig. 46. Wax removal at the stripping table. After the wax is hardened the birds pass over the stripping tables where the wax is flaked off, taking the small feathers and pin feathers with it. The flake wax drops into cans beneath the table or is carried away on a conveyor belt for reclamation. (U.S.D.A.)

Cropping and Cleaning Vents

The small volume of poultry that is still packed as dressed or New York dressed (blood and feathers removed) passes from the picking area to cropping and venting stations. Here excess feed and fecal matter are removed by a massaging motion. Sometimes the crop is removed entirely at the cropping station. These steps are not necessary when ready-to-cook poultry is being prepared, because the crops and vents are removed during the eviscerating operations.

Singeing

To remove the hair-like feathers, the birds pass through a singer. The singer may consist of a bank of gas flames that burn continuously or that burn intermittently through automatic controls. Each bird is momentarily enveloped in flame so that hair is removed from all parts of the body without any burning of the skin.

Washing

From the singer the birds pass through a spray washer where water jets at various angles are directed against them to clean and partially cool them. Water spraying is sometimes augmented by a mild scrubbing action from banks of slowly rotating rubber fingers.

Chilling

After washing, the birds are removed from the conveyor line and put into a chill tank of slush ice. After chilling, the poultry that is to be shipped as New York dressed is ready for grading and packing. However, as it was noted earlier, most of the poultry is now prepared as ready-to-cook and further operations are performed prior to the chilling and packing.

PREPARING READY-TO-COOK POULTRY

Ready-to-cook (eviscerated) poultry was of noticeable importance in the 1930's, but it did not become popular nor did its use expand rapidly until the late 1940's. The term ready-to-cook, which is of relatively recent origin, requires that the bird be prepared so it is ready-to-cook without further processing. This expression means complete evisceration with exacting specifications, in contrast with the looser term "drawing," which indicates no particular degree of evisceration and no official inspection. Ready-to-cook poultry requires

the removal of the head, shanks, viscera, crop, esophagus, trachea, pin feathers, vestigial feathers (hair or down), oil gland, lungs, kidneys, and any seriously bruised areas on the carcass.

Although the following operations are required for producing ready-to-cook poultry, the sequence of the various steps may vary. Usually an assembly-line type of operation is set up with the stations divided according to size of plant and type of birds being worked:

Inspection

The dressed birds are inspected for pin feathers or other dressing defects. Birds that are pinny are removed from the line for complete picking prior to entering the eviscerating room. All acceptable birds are placed on the eviscerating line, suspended by the head, ready for later operations.

Removal of Oil Gland

The oil gland, which is located at the base of the tail, is removed by a deft stroke with a sharp knife.

Removal of Crop

The skin at the back of the neck is slit from the shoulders to the head. The crop and windpipe are separated from the head and connecting tissues and removed.

Removal of Viscera

In preparation for removing the viscera, the feet of each bird are also hung from the shackle. Then a vertical cut is made in the abdomen extending from near the keel bone down to a point near the vent and around the vent. The viscera are pulled by hand and allowed to hang below the bird. This prepares the bird for post-mortem inspection. At this point, plants operating under the U.S. Department of Agriculture Poultry Inspection Services have an official inspector who examines each carcass for condition and wholesomeness. Unwholesome birds are removed (Fig. 47). Normally, the rejection rate is low. Birds that pass this inspection move on to further operations.

Removal of Giblets

The next step is to remove the giblets from the viscera. Giblets is a collective term that includes the liver, gizzard and heart.

The liver is removed from the viscera by clipping with scissors. Care is exercised to avoid breaking the gall bladder, because if broken,



Fig. 47. Inspection of poultry by a federal government veterinarian. (U.S.D.A.)

a bitter flavor is apt to pervade the liver. The gall bladder is trimmed from the liver, and then the liver is washed and allowed to drain.

The gizzard is removed from the viscera, cut open, and the contents are removed by washing. The gizzard lining is peeled by hand or removed by a special machine.

The heart is then removed from the viscera, trimmed, and washed.

Removal of Lungs and Kidneys

The lungs are removed by hand or with a vacuum machine. The kidneys, ovaries, and testes are removed by hand or with a kidney remover. The most effective kidney remover is a vacuum device.

Removal of Head and Shanks

The heads are usually removed automatically. With the bird hanging by its feet in the shackle, the head is guided into a V-shaped track and pulled off by sheer force or severed by a rotating blade.

The shanks are removed at or just below the hock manually by using hedge clippers or a knife, or they may be removed with a band saw.

Final Inspection

At this station the birds are checked for complete evisceration. If found incomplete, the birds are reworked here until acceptable.

Washing

The birds are then washed thoroughly both inside and outside.

Cut-up Poultry

Another recent development in the preparation of poultry, the cut-up style, is proving popular. After evisceration the chicken is cut into any parts desired and usually packed into trays for display and sale in the retail stores. If half chickens are desired, the back is split, usually with a band saw (Fig. 48). Cut-up chicken parts are ordinarily cut, packed, and weighed on an assembly line. Parts such as wings, necks, breasts, legs, and the like may be packed separately or all parts packed together, according to the consumer demand.



Fig. 48. Cutting up fryers. One operator removes the neck and wings while another makes the final cuts with a band saw. (U.S.D.A.)

CHILLING AND FREEZING POULTRY

In the processing of poultry, the birds may be chilled prior to or after eviscerating—usually after eviscerating. The speed and cleanliness with which the eviscerating operations are completed in modern plants leave little opportunity for bacterial growth to get started. In addition, recent developments in the use of antibiotics in the chilling water have helped to lengthen the shelf life of fresh eviscerated poultry considerably. Nevertheless, it is standard procedure to reduce the body temperature to 35° F or less as quickly as possible.

Dry Chilling

Chilling of poultry on racks, or otherwise exposing it to refrigerated air, has for many years been the approved method. It is no longer practiced because of excess loss in body moisture and the inefficient use of refrigeration.

Wet Chilling

Modern methods of chilling provide that the birds be placed in portable or stationary vats, or barrels. Water and crushed ice is added as the container is filled with poultry. To chill the birds to an internal temperature of 36° to 40° F, 1 to 10 hours in the water is necessary, depending upon the size of the birds, the temperature of the water, and whether the water is agitated. To agitate the water, compressed air is piped to several points in the bottom of the container, and the resulting agitation cuts the chilling time to 1 to 2 hours. Birds chilled by this method absorb water, increase their weight slightly, and the carcass is plumped to some extent. Movable metal vats mounted on casters have become increasingly popular. A chill-tank tipper⁹ has been perfected which lowers the labor cost and inconvenience of older methods of emptying such vats.

In recent years the prevailing method for preparing chilled (fresh and unfrozen) poultry has been to pick by semiscalding and chill with ice and water; quite satisfactory results have been obtained. A new spin-chill process just placed on the market is said to chill broilers ready for ice-packing in 20 minutes. According to the manufacturers, this process avoids the labor and time lost in using chill tanks. Such innovations are added demonstrations that poultry processors, in order to compete successfully in quality and cost, must be ready to adopt new methods as fast as they are offered and their effectiveness is proven.

Use of Antibiotics in Chill Water

The U.S. Food and Drug Administration has approved two antibiotics for mixing into chill water for increasing the storage and store shelf life of the chilled poultry.¹⁷ The two antibiotics approved so far are chlortetracycline and oxytetracycline. As of January 1959 it was estimated that about 8 per cent of the poultry processed in the United States was treated with one of these antibiotics.

The antibiotic is mixed with the water and crushed ice, and usually the chilling solution is agitated by compressed air. The birds, after chilling, are removed, drained, and packaged. The improved appearance of the birds after storage or exposure in the retail store seems to justify this extra cost.

Freezing Poultry

Freezing rooms called freezing tunnels have been installed in some plants (Fig. 49). The temperature of these rooms is maintained at -25° to -50° F. In the freezer the boxes of poultry are stacked



Fig. 49. Freezer tunnel (Birdseye-Snider packing plant, Pocomoke City, Md.). Note fins on side walls for deflecting frigid air blown in through side vents.

loosely or separated with strips of lumber to allow the circulating air to remove the heat rapidly and uniformly. Large fans in the freezer tunnel promote good air circulation. The fans are generally located in the ceiling, and the air is moved through vents on the side and deflected over the poultry by a series of fins built on a slight slant from floor to ceiling. The usual practice is to still-chill the poultry before packing and placing in the tunnel for freezing. Most poultry for freezing is prepared in ready-to-cook form and overwrapped with plastic film before being packed in boxes for freezing.

A recent innovation has been to pack poultry in plastic bags and then to start freezing in a solution of Propylene-Glycol.¹¹ It is claimed that a combination of sprays and immersion in a -5°F solution, followed by normal freezing practices, makes possible the freezing of turkeys in 1 to 2 hours.

PLANT LAYOUT AND FACILITIES

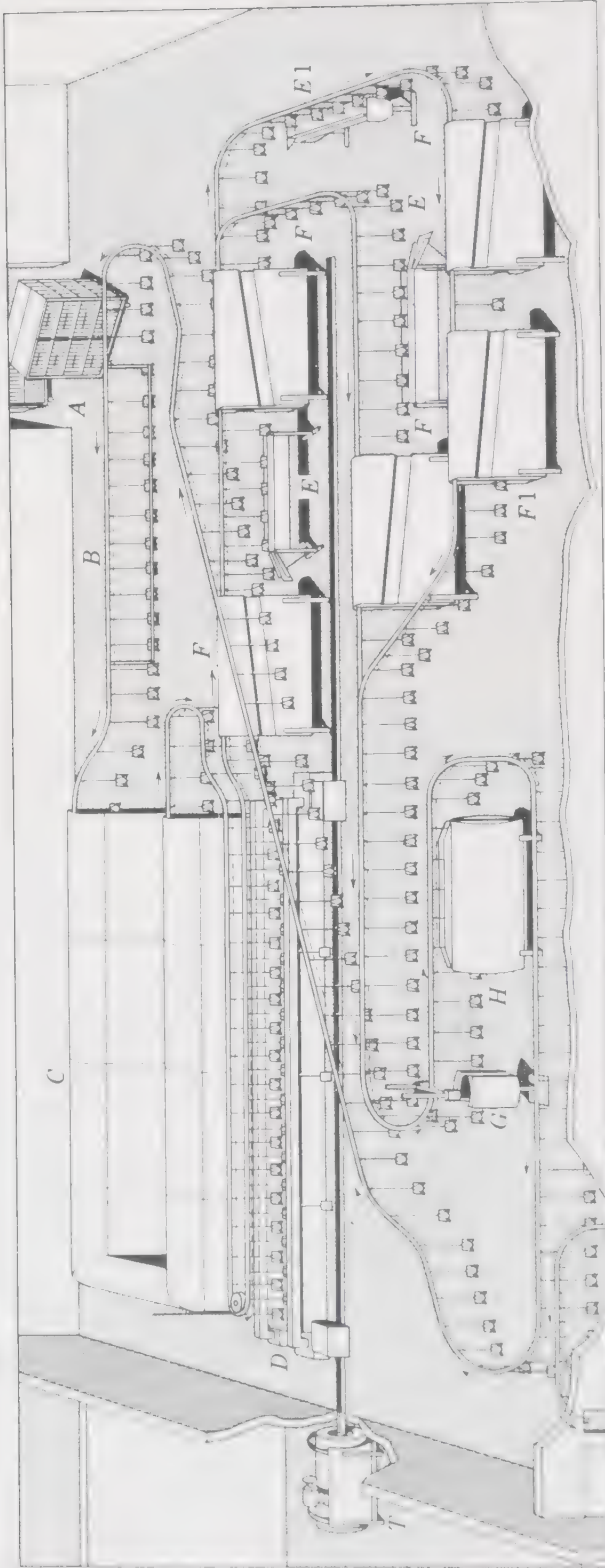
Modern poultry slaughter plants are designed and built to take advantage of all possible efficiencies in materials handling.¹⁰⁴ The newer plants are typically of one-story construction with loading and unloading platforms at truck-bed level. Steel and concrete construction makes them fire resistant, and with the proper design of rooms and space, enables them to meet the specifications of local, state, and federal regulations.³⁵ Expert advice should be obtained by anyone contemplating the construction or modernization of a dressing or eviscerating room. New equipment and changes in the market demand for the product require the rooms to be closely fitted to the capacity and type of operation needed.

Sufficient space should be allowed so that modern mechanical equipment can be installed (Figs. 50, 51.) Nearly all plants that slaughter more than 30,000 pounds per week, while in operation, have overhead conveyor systems.

Eviscerating Room

The room where these operations are performed should be installed and equipped so as to be attractive and insure the highest degree of sanitation. Smooth walls impervious to moisture, adequate lighting, and good ventilation are important features.

An important factor to consider in planning such a room is the capacity per hour;²⁴ a limiting factor is the number of birds that can be inspected per hour. Where post-mortem inspection is practiced, a maximum of about 1,200 broilers per hour is the upper limit if the



(a)

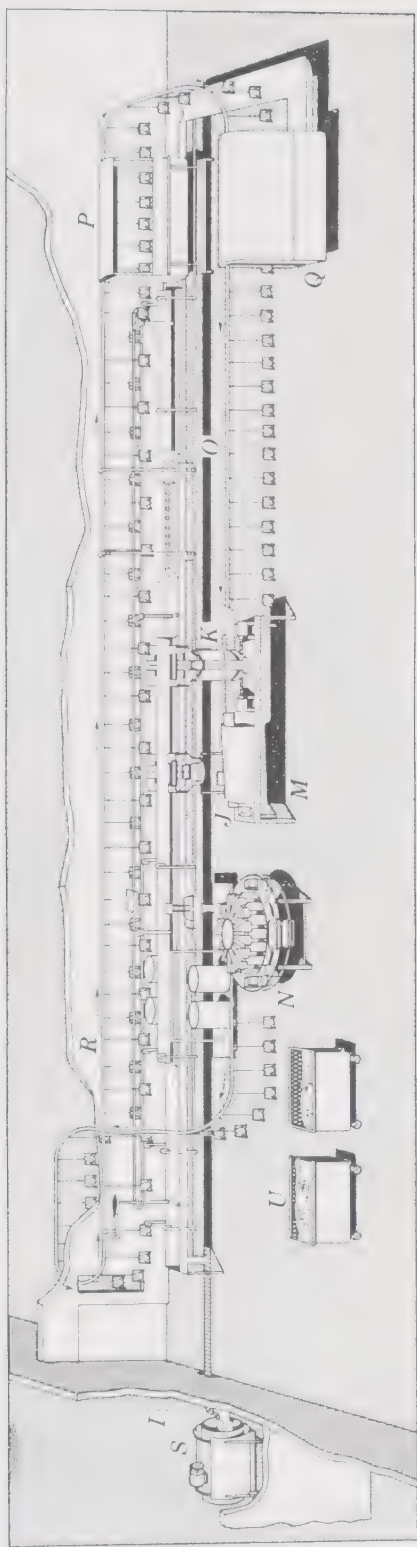


Fig. 50. Diagrams for poultry dressing and eviscerating rooms. (Courtesy Gordon Johnson Co., Kansas City, Mo.) (a) Poultry dressing room (capacity 2,000 to 3,000 birds per hour). A, Batteries or coops; B, overhead conveyor; C, bleeding tunnel; D, sofscaider; E, neck and hock scalders; F, multi-matic pickers; G, rotary feather separator; H, washer; EI ° and FI. ° (b) Poultry eviscerating room (may be adjacent to dressing line and provide easy transfer of dressed birds from former to latter line). I, Offal drops to floor gutters; J, heart and liver stations; K, gizzard stations; M, from skinning operators gizzards flow into washer; N, giblets are packaged on rotary packaging unit; O, automatic head cutter; P, inside bird washer; Q, outside bird washer; R, overhead conveyor; S, rotary offal separator; U, chill tanks with dri-lifts.

° This equipment, EI and FI, is supplementary; may be used for increasing the capacity of the operation.

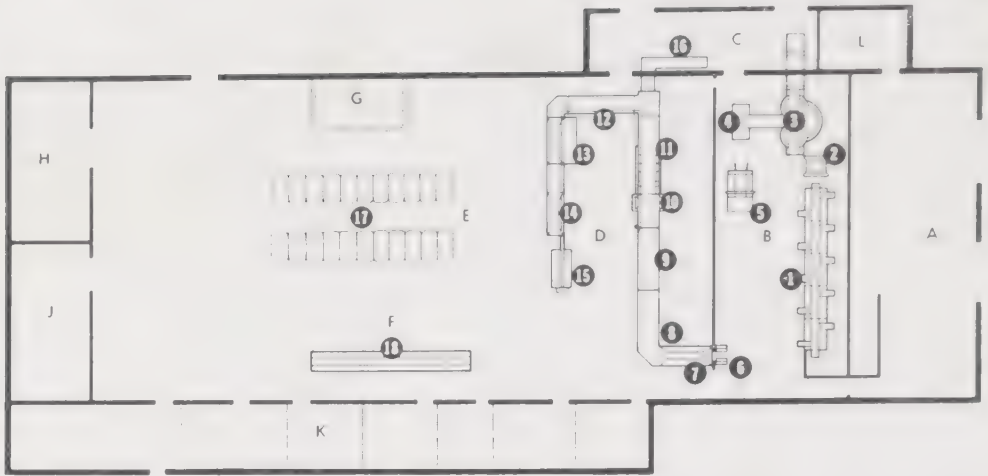


Fig. 51. Diagram for poultry dressing and eviscerating operations in one room. (Partitions may be installed if desired.) Plant layout: A, holding or receiving area; B, scalding and picking area; C, offal and feather area; D, eviscerating area; E, sizing and cooling area; F, packing area; G, ice bin (overhead); H, cooler; J, freezer; K, office area; L, boiler. Equipment recommended for 2,500–3,000 broilers per hour; 1, sectional scalding tank, 25'; 2, garter picker; 3, dual cyclomation free-action picker with feather separator and conveyor; 4, rehang table; 5, six-foot neck and wing picker; 6, singer; 7, spray washer; 8, cropping and opening trough; 9, inspection and eviscerating trough; 10, gizzard peeling and washing unit; 11, giblomatic giblet flume and washer; 12, lung and kidney trough; 13, inside washer, mounted on trough; 14, outside washer, mounted on trough; 15, giblet packaging and stuffing table; 16, offal separator and elevator; 17, chill tanks; 18, packaging or cut-up table. (Courtesy Barker Poultry Equipment Co., Ottumwa, Iowa.)

poultry is healthy and normal. The rate of operation for turkeys is ordinarily less than half that for chickens. If more than 10,000 birds are prepared in an 8-hour day, additional lines are needed.

The major equipment necessary for an eviscerating operation and a typical layout is shown in Figs. 50 and 51.

COMPUTING COSTS

Since costs vary with changes in the price level, productivity of labor and facilities, scale of operations, and other factors, no attempts will be made to compute costs based on today's market conditions. However, an awareness of one's costs and a method of computing them is absolutely essential because the industry has become highly competitive with profits figured in fractions of a cent.

Shrinkage

Shrinkage is a loss in weight, and conversely the amount that remains is called yield. Procurement shrink is the weight loss by the live birds between the farm and slaughter plant. Dressing shrink is the weight loss incurred when the blood and feathers are removed. Eviscerating shrink is the weight loss resulting from the removal of the head, feet, and viscera.

Shrinkage varies in all of the stages of marketing and processing. Some of the factors causing variation in shrinkage are age, sex, weight, condition, kind of poultry, temperature, and humidity. The ability of management to control and minimize shrinkage and still market an acceptable product can mean the difference between profit or loss. Some typical shrinkages are shown in Table 18.

For the plant operator, shrinkage, wherever it occurs, is considered a cost of doing business. It is a factor, for example, in deciding how much can be paid for a flock of birds that is molting versus a flock of birds that is not.

Grade Yield

A closely related factor to shrinkage, and one that is sometimes confused with it, is grade yield. Buyers try to estimate the per-

Table 18. Shrinkage Percentages in Commercial Poultry Processing

Kind of Poultry	Shrinkage from Live to Ready- to-Cook Weight
<i>Per Cent</i>	
Chickens	
Broilers and fryers	28.0
Roasters	27.6
Fowl	27.0
All chickens	27.8
Turkeys	
Fryer-roasters	24.0
Heavy hens	20.4
Heavy toms	19.1
All turkeys	20.3
Ducks	27.0
Geese	22.5

Source: See reference 40 in the Bibliography.

centages of Grade A, B, and C birds and those that will be a loss when they offer a price for a flock of live birds. A flock that is processed and grades out 95 per cent A and 5 per cent B is, of course, better than one that grades out 80 per cent A, 10 per cent B, 5 per cent C and 5 per cent loss. To avoid this problem some plants have a policy of paying producers on the basis of grades and yields obtained after processing.²⁴

Cost Calculations

It is vital, in these days of keen competition, for the poultry processor as well as any other business man, to make sure that he knows his costs. Simple methods for calculating cost of the poultry going into the finished product are indicated by the following examples in which the particular figures used are for showing the calculations only and bear no intentional relationship to prevailing price levels.

To calculate meat cost of live broilers delivered at plant assume:

10,000 lb broilers bought from farmer @ 20¢ lb at farm	\$2,000.
9,850 lb weighed in at plant	

150 lb road shrink, 1½% (0.3¢ lb) yield	98.5%
Meat cost of 9,850 lb @ 20.3¢ lb	\$2,000.
Trucking and other nonshrinkage procurement costs, 0.3¢ per lb of poundage bought	\$ 300.
Total procurement costs (shrinkage and nonshrinkage), 0.6¢ per lb of poundage bought	\$ 600.

To calculate meat cost of ready-to-cook broilers from previous example, assume

9,850 lb live broilers at plant cost 20.3¢ per lb	\$2,000.
2,758 lb 28% live to ready-to-cook shrinkage (from Table 18)	

7,092 lb yield of ready-to-cook meat (28.2¢ per lb)	\$2,000.
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To figure total cost of finished product from above examples, assume

Original cash cost	\$2,000.
Additional cost of labor, packaging, cooling, plant overhead and financing amount to 6¢ per lb of the yield of ready-to-cook meat (7,092 lb)	\$ 425.52
Trucking and other nonshrinkage procurement costs	\$ 300.00

	Total nonshrinkage costs	\$2,725.52
Total cost per lb of output (7,092 lb)		38.4¢

Questions

1. What method of poultry killing is most common in your area?
2. What method of scalding is most common in the processing plants nearest you, and why is that method preferred?
3. Draw a diagram of an efficient poultry processing room. Use good principles of materials handling in showing the flow of materials and the position of the various machines necessary.
4. Outline the factors concerned with shrinkage from the time the birds are picked up at the farm until the consumer purchases the final package.

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Grading and Packing Poultry

GRADING

Grading of dressed or ready-to-cook poultry is done according to specifications of an individual firm, industry agreement, municipal, state, or federal regulations. Whatever the source of the list of specifications used, the basic reason for grading is to classify the products according to characteristics that have an economic value. The reasons for grading as given in Chapter 5 apply with equal force to the grading of dressed or ready-to-cook poultry.

According to the U.S. Department of Agriculture's standards, the characteristics employed in grading dressed or ready-to-cook poultry are grouped as follows:³⁶

1. Kind or class of poultry
2. Condition
3. Quality

Kinds of Poultry

The kinds of poultry are chickens, turkeys, ducks, geese, guineas, and pigeons. The various classes of each kind of poultry were described in Chapter 7. The same terminology is used for dressed and ready-to-cook poultry.

Condition

This refers to evidences of disease or any other condition which may render the birds unwholesome or unfit for human consumption. The following conditions exclude poultry from any grade:

1. Decomposition.
 - a. Slippery or slimy condition of the skin.
 - b. Greenish cast over the back and between the thigh and rib.
 - c. Mold growth anywhere on the bird.

d. Putrid off-odor.

e. Green vent or green area surrounding the vent.

2. Extreme emaciation.

3. Birds bruised or mangled in excess of that which is permitted in C Quality.

4. Ready-to-cook birds showing obvious external or internal evidence of diseases that make the bird unfit for human consumption.

5. Birds with tumors, sores, or external scabs.

6. Anemic condition.

7. Cadavers, that is, birds that died other than by slaughter.

8. Carcasses with abdominal accumulations of fluid or cheese-like substances.

Ready-to-cook birds with any of the following conditions would not be graded, but would be sent back for further processing.

1. Protruding pinfeathers.

2. Bruises requiring trimming.

3. Lungs or sex organs incompletely removed.

4. Parts of the trachea.

5. Vestigial feathers.

6. Feathers.

7. Extraneous material of any type, such as fecal matter or blood, inside or outside of the carcass.

Dressed poultry carcasses which show any of the following conditions cannot be given any quality designation: dirty head, bloody head, dirty carcass, bloody carcass, dirty vent, dirty feet, feathers on the carcass, and feed in the crop. The crop may be removed or an incision made and the crop-contents washed out.

A large number of abnormal conditions develop in the internal organs of birds. These organs and the internal surfaces of the body cavity should be examined by a person who has received special training in the detection and identification of poultry diseases. Old birds are more apt to have such abnormal conditions than young birds.

Under the grading and inspection programs of the U.S. Department of Agriculture, ready-to-cook poultry must have been inspected for condition and wholesomeness by a federal inspector and be properly identified as an inspected product to be eligible for grading, whether the grading is done by a licensed grader in an official plant or elsewhere. When the poultry is in dressed form, individual birds may not be identified with the grade mark. However, the bulk containers

may be identified with the grade mark. The official grading service is available on a voluntary and almost self-supporting basis.

The acceptance of the inspection program by the industry is shown by the following: a study³⁹ of poultry slaughtered in commercial plants during the last 6 months of 1955 disclosed that an average of 88 per cent of all poultry slaughtered was eviscerated in the slaughtering plants. This ranged from 65 per cent for ducks and geese to 95 per cent for turkeys. Approximately 36 per cent of the poultry processed in commercial plants was inspected for wholesomeness by the U.S. Department of Agriculture. By kind of poultry, the proportion ready-to-cook which was officially inspected was 20 per cent for broilers and other young chickens, 51 per cent for mature chickens (hens and cocks), 74 per cent for turkeys, and 20 per cent for ducks and geese.

The United States Congress enacted legislation on August 28, 1957, which required that by January 1, 1959, all poultry and poultry products moving in interstate or foreign commerce be inspected for wholesomeness, unless otherwise exempt. After January 1, 1959, dressed poultry was not permitted to move in interstate commerce except between official plants or from official plants to foreign trade. Except for the fact that costs are borne by the federal government, the inspection program carried out under the new law is operated in a manner similar to the voluntary program.

Quality Factors

The factors below are considered in determining the quality of an individual carcass.

Conformation. When viewed from the side, the bird that more nearly fills a rectangle is preferred to one that approaches the shape of a triangle. Defects are breasts that are dented, crooked, knobby, V-shaped, or slab-sided; backs that are narrow, crooked, or hunched; legs and wings that are deformed or swollen; and bodies that are definitely wedge shaped. A bird of A Quality is of normal physical conformation; a bird of B Quality has practically normal conformation; and a C Quality bird may have abnormal conformation if it is fairly well fleshed.

Fleshing. The drumsticks, thighs, and breast carry the bulk of the meat. Defects are breasts that are V-shaped or concave, rather than full and rounded; breasts that are full near the wishbone but taper sharply to the rear; thighs and drumsticks which are thin; and backs that have insufficient flesh to cover the vertebrae and hip bones. A bird of A Quality is well fleshed; a B Quality bird is sufficiently well

fleshed on the breast and legs so as to prevent a thin appearance and prominent breastbone; and a C Quality bird may be poorly fleshed.

Fat. Some markets have a preference for birds with white or light colored fat; others prefer yellow fat. Since the fat tends to take on a darker hue with age, it may be indicative of the age of the bird. Fat in poultry is judged entirely on the basis of accumulation under the skin. It occurs first around the feather follicles in the heavy feather tracts. As the bird progresses in "finish," accumulations of fat will be noted at the juncture of the wishbone and keel. A bird of A Quality is well covered with fat over the breast, back, hips, and pinbones, except that broilers or fryers and young tom turkeys may have only a moderate amount of fat. A bird of B Quality has sufficient coverage of fat on the breast and legs to prevent a distinct appearance of the flesh through the skin. A bird of C Quality may be lacking in fat covering over all parts of the body.

Pinfeathers and Hairs. Two types of pinfeathers are considered in grading—protruding and nonprotruding. Protruding pinfeathers have broken through the skin and may or may not have formed a brush; these are not permitted on ready-to-cook birds. Nonprotruding pinfeathers are visible but have not pushed their way through the outer layer of skin. A bird of A Quality is almost free from pinfeathers and vestigial feathers, especially on the breast. A bird of B Quality may have not more than a slight scattering over the entire carcass and only relatively few on the breast. A bird of C Quality may have numerous pinfeathers and vestigial feathers scattered over the entire carcass.

Cuts, tears, and broken bones. A bird of A Quality is free from cuts and tears on the breast and legs. There are some exceptions for other parts of the carcass. A bird of B Quality may have cuts and tears on the breast and legs the aggregate length of which does not exceed 1½ inches and elsewhere on the carcass if they do not exceed an aggregate of 3 inches. A bird of C Quality may have torn skin, missing skin, disjointed bones, and broken bones, but only if there is no evidence of a related severe bruise or blood clot.

Discolorations of skin, blemishes, and bruises. A bird of A Quality is free from bruises and discoloration of the flesh on the breast and legs, but it may have relatively small amounts elsewhere on the carcass. A bird of B Quality may have flesh bruises on the breast and legs showing not more than a slightly darkened color to the extent of an aggregate area of ½ inch in diameter and elsewhere on the carcass not to exceed an aggregate of 1½ inches in diameter. A bird of C

Quality may have numerous and large discolored areas or blemishes on the skin which may be accompanied by some reddening and darkening of the flesh, if this does not make any part of the carcass unfit for food.

Freezer burn. This is the discoloration and drying out of the skin that occurs during storage. Frozen poultry sometimes shows a condition known as "box burn." This shows up as a white area where the skin of the bird has come in contact with the lining of the box. A bird of A Quality shows only a slight freezer burn. A bird of B Quality may show moderate freezer burn but not in excess of $\frac{1}{2}$ inch in diameter. A bird of C Quality may show more than a moderate amount of freezer burn.

Determining the Grade

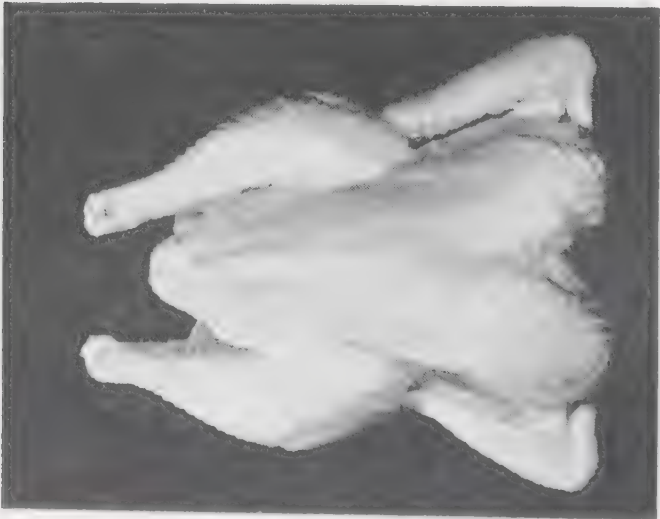
In determining the grade of an individual dressed or ready-to-cook bird, all three of the grading factors need to be considered, that is, kind of poultry, condition, and quality. For those who may wish to use the grades of the U.S. Department of Agriculture, it is recommended that a copy of the *Poultry Grading Manual*³⁶ be obtained, because it contains many additional details which could not be presented here.

Since the grading factors cannot be measured exactly, graders can be expected to vary some in their interpretations. Occasional reference to the standards is recommended so that the judgment of the individual is not biased when the lots are running consistently low or high in quality or condition. Because of the variances of human judgment in interpreting the grades, tolerances are established.

For dressed or ready-to-cook poultry any lot of birds may be designated as "U.S. Grade A" if at least 90 per cent of the birds are A Quality and the remainder are B Quality, and no individual container in the lot has more birds of B Quality than in the proportion of 2 to each 12 birds in the container. Any lot of birds may be designated as "U.S. Grade B" if at least 90 per cent of the birds are B Quality and the remainder are C Quality, and no individual container in the lot has more birds of C Quality than in the proportion of 2 to each 12 birds in the container. Any lot of birds may be designated as "U.S. Grade C" if it consists of birds not poorer than C Quality. Most of the differences between A, B, and C grades are shown in Fig. 52.

Weight Specifications

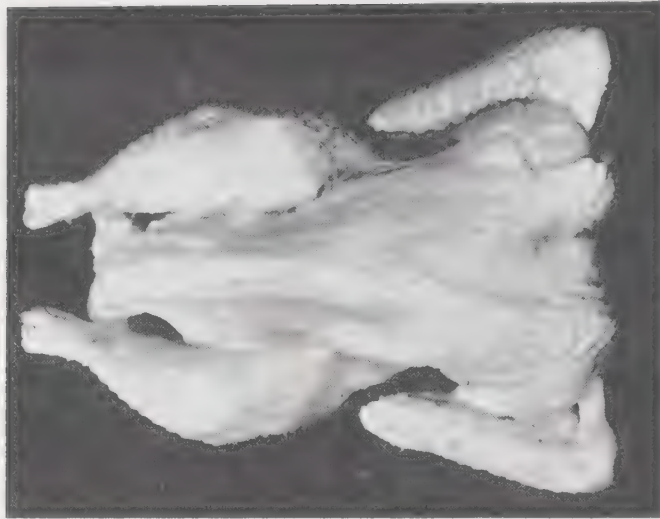
Weight specifications are not included in the grades, but they are significant in meeting trade needs and requirements. Buyers are in-



A Quality



B Quality



C Quality

Fig. 52. Hen, stewing chicken or fowl. (U.S.D.A.)

terested in purchasing lots of poultry sorted uniformly for weight as well as grade.

Any system of marking packages should be simple if the fundamental purpose (informing buyer, seller, and service agencies such as warehouses), is to be accomplished. Short, simple code numbers should be of sufficient size to be easily recognized.

PACKAGES

Packaging Chilled (Unfrozen) Whole or Cut-up Chickens and Turkeys⁹⁸

Chilled whole ready-to-cook chickens and turkeys that are eviscerated in the processing plant generally are packed in wire-bound wooden containers with crushed or chipped ice, for delivery to wholesalers or retailers (Fig. 53). Paper liners for the containers are usually made of vegetable parchment paper. The majority of these



Fig. 53. Wirebound box lined with vegetable parchment paper. Crushed ice is mixed through the package to retain the fresh bloom of the unfrozen poultry. (Courtesy Wirebound Box Manufacturing Asso., Chicago, Ill.)

birds are cut up and packaged by the retailer in a tray with a tight, transparent film overwrap.

There are many kinds of trays—formed, laminated, heavily-waxed and open-mesh plastic. Moisture-absorbing paper padding in several forms is used to keep the poultry better looking and to lessen film clouding. Pulp type trays are said to hold their rigidity without the pad.

The trend is for the processors to tray pack with a film overwrap. With such packing the birds can be shipped in crushed or chipped ice, or they can be frozen and at the retail point are thawed before they go into the display case.

A corrugated foil-laminated container for packing 12 trays of cut-up chicken is being manufactured. The containers are shipped under refrigeration, and no ice is used. The use of the foil gives the box higher heat reflectivity and greater vapor resistance.

Corrugated fiber containers are being used to a limited extent for ice-packed poultry, with varying degrees of success. There has been some experimentation with plastic between layers of kraft liner, with aluminum liners, and also with wax-type boards used to create a barrier against water penetration in corrugated fiber containers.

Packaging Frozen Poultry

Ready-to-cook poultry (whole birds) that may be held for a relatively long period of time should be individually wrapped, or each bird should be placed in a bag made of moisture-vapor proof transparent plastic film and packed in boxes for freezing and shipment.⁹⁸

The solid fiberboard box made with 0.09-inch weatherproof solid fiberboard is considered an excellent fiber container for storage and export shipment involving heavy net weights, such as could be expected in boxes of 4 to 6 turkeys. One style of fiberboard shipping container is formed in part by 4 individual turkey boxes which fit into a sleeve that makes up 4 sides of the over-all container.

The corrugated fiber box costs less than the solid fiber but does not possess the bursting strength or rigidity. To be most acceptable the corrugated fiber box should be sturdy, durable, and moisture resistant enough to be moved in and out of storage with a minimum buckling of the sides under a stack load.

Frozen cut-up poultry is usually packed in paperboard cartons lined with a moistureproof film and an overwrap and then packed in a shipping container. Corrugated fiber containers are used almost exclusively for frozen poultry (Fig. 54).



Fig. 54. Paperboard cartons containing quick-frozen, cut-up, ready-to-cook chicken and packed in a corrugated fiberboard shipping container. (U.S.D.A.)

Barrels. Barrels are not generally used except for a limited use of veneer barrels for moving dressed poultry from one processing plant to another (Fig. 55). Compared with ordinary stave barrels, the initial cost of veneer barrels is lower, and the cost for transportation is less. The empties can be shipped flat. Veneer barrels require less space for storage in processing plants, they pack more closely in a truck for shipment, and the joints provide greater ventilation.

Boxes. Poultry is packaged in a variety of boxes, mostly veneer or fiber. The packaging requirements depend largely upon the kind of outlet and whether the poultry is to be ice-packed or dry-packed and frozen.⁹⁸

Veneer boxes. The wirebound veneer box is simple to set up in the packing plant and easily fastened after packing, as it is closed by wire loops. Moreover, it is easily inspected, as no nails need to be drawn and redriven. As it is an open-type package, because of the spaces between the pieces of veneer, careful wrapping of the birds is necessary to prevent freezer-burn during storage. The wirebound veneer has become popular in plants that ice pack poultry. Recently a

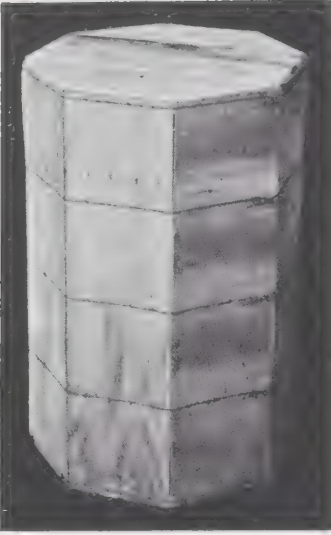


Fig. 55. One type of veneer barrel. (Courtesy Package Research Laboratory.)

machine has been developed for automatic closing and fastening of these boxes.

Fiber boxes. Fiber boxes are used successfully as master shipping containers that hold several packages made of cardboard chipboard. However, if the fiber box is used for storing poultry, the ordinary type gradually absorbs moisture and loses its rigidity, so that when boxes are stacked in piles the bottom boxes may collapse. Furthermore, when the boxes are withdrawn from the freezer, moisture condenses upon them; if much of this moisture is absorbed, they may be torn apart when handled. New types of fiber boxes are being developed, which have the advantages of light weight, tight sealing, and quick assembling. Fiber boxes for individual ready-to-cook turkeys have become popular in recent years.

Sawed wood boxes. The boxes made from sawed lumber, usually cottonwood, tupelo, or gum, are the most rigid type, but they are heavy, carry the greatest tare in shipment, and are rapidly losing popularity.

Sizes of containers. Containers are usually designed to hold 1, 6, or 12 birds. Containers that hold 12 birds are still popular, although the other sizes are increasing in popularity. Containers holding 6 birds are used most extensively for turkeys and special packing of heavy roasting chickens. The smaller container, advantageous because of the decreased weight in handling, is also convenient for markets doing a small volume of business. As each class of poultry varies in conformation as well as size, some packing plants have to stock 30 to 40 different styles and sizes of containers.⁹⁸

Linings. Containers for handling poultry should be lined with some satisfactory material. Parchment, imitation parchment, or wax-coated paper, white or tinted, is most frequently used. Some packers use a decorative paper, sometimes with scalloped edges. Cellophane and similar materials, metal-surfaced papers, and plastic-film papers are also used.

Some packers use a waterproof, moistureproof, asphalt-centered paper lining. The idea is to prevent, as far as possible, the escape of moisture during storage.

ICE PACKING

Some packers of ice-packed poultry using wirebound veneer boxes place 3 inches of crushed ice in the bottom of the container, then pack a layer of poultry, then about 2 inches of crushed ice and another layer of poultry. The remaining space is filled with crushed ice. About 20 pounds of ice is used per 50 pounds of poultry. Most packers line the container with parchment paper before filling, as the paper furnishes not only insulation but also a pleasing appearance when the box is opened. The outside of the container is usually stenciled with gross, tare, and net weight, and the number of head, kind, and grade of poultry.

A similar procedure is followed when other kinds of packages are used, such as celery crates, orange crates, or barrels.

The study³⁹ mentioned earlier showed that 88 per cent of the broilers and other young chickens, 55 per cent of the mature chickens (hens and cocks), 18 per cent of the turkeys, and 34 per cent of the ducks and geese slaughtered in commercial plants in 1955 were not frozen. Thus, a significant proportion of the young chickens, hens, and cocks were marketed in ice-packed or chilled form.

DRY PACKING FOR FREEZING

When poultry is packed dry for freezing, the birds are first chilled to remove body heat. Procedures similar to those described earlier are followed except that ice is not used. Careful attention should be given to packing the birds so they will present a pleasing appearance after freezing and will carry well in storage and through the marketing channels. The containers described earlier are also used for dry-packing poultry for freezing.

For freezing, it is preferable for each bird to be entirely wrapped, except for the legs, in parchment paper. Wrapped birds, loosely packed, are transported with less jamming and are easily removed from the container. Wrapping the birds is especially important if the packages are to be solidly frozen; this eliminates the danger of the birds freezing together which may cause broken legs, wings, or necks if the packages are unpacked in frozen condition. If each bird is wrapped in parchment paper, no paper is necessary between layers.

Barrels are seldom used except in special instances such as for institutions or for interplant transfers. The filled barrels are too heavy for easy handling, and the birds are usually distorted and unattractive when removed.

Questions

1. Define condition as it applies to grading and packing processed poultry.
2. What conditions of processed poultry would require that the poultry be sent back for further processing?
3. List the quality factors to be considered in determining the quality of an individual carcass.
4. Why are tolerances allowable in graded poultry? Give an example of what might occur in a box of 12 fowl marked Grade "A".
5. Visit a large market and make arrangements with the manager to observe the type of package used by the wholesaler supplying him with poultry products. Get information as to the number of birds per package and codes and grade symbols used.
6. What methods are used to cool poultry after slaughter? Why is it considered necessary?

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- Also reference 100 in the Bibliography.

The Poultry Products Industry

A wide variety of poultry products and by-products are of sufficient economic importance to merit special discussion.

FOOD PRODUCTS

Canned and Processed Poultry

Poultry is used in canned, frozen, and dehydrated products. Canned chicken soup is probably the best known of these, but there are many others including such items as wet- or dry-packed chicken meat, whole cooked chickens, chicken broth, chicken à la king, chicken croquettes, chicken pot pies, fried chickens, cooked chicken livers, chicken and noodles, chicken tamales, chickenburgers, turkey à la king, turkey sticks, smoked turkey, turkey sausage, and turkey rolls.

The industry that has produced these and other products is not large in terms of the proportion of the crop utilized. However, it has shown definite growth. During and after World War II this industry used approximately 100 million pounds of poultry, ready-to-cook weight, or about 3 per cent of the commercial poultry meat production (Table 19). Since 1950 the amounts of poultry used have increased, with a marked upward surge evident during the period 1954-1958. In these years the frozen chicken pie and chicken dinner products became increasingly popular. More than 4 per cent of the commercial poultry meat production or approximately 200 million pounds was used on the average for canning and other processed foods during that period.

In a study⁶⁶ of the frozen prepared foods industry, estimates were made that 43.7 million pounds of poultry pot pies and 3.5 million pounds of other frozen poultry prepared foods were manufactured in 1954. Although it is difficult to estimate the amount of poultry used in these prepared food products, it is clear that this segment of the industry has shown very rapid growth in recent years and probably

Table 19. Poultry Used in Canned and Other Processed Foods Compared with Commercial Poultry Meat Production

Year	Poultry Used in Canned and Other Processed Foods *	Commercial Poultry Meat Production †	Per Cent Prepared Poultry Is of Total
	<i>Million pounds ‡</i>	<i>Million pounds</i>	
1943	68	2,785	2.4
1944	100	2,691	3.7
1945	111	2,994	3.7
1946	94	2,668	3.5
1947	66	2,589	2.5
1948	111	2,427	4.6
1949	97	2,989	3.2
1950	115	3,210	3.6
1951	129	3,653	3.5
1952	146	3,862	3.8
1953	140	3,905	3.6
1954	179	4,216	4.2
1955	186	3,963	4.6
1956	196	4,892	4.0
1957	227	5,055	4.5
1958	261	5,646	4.6

* Computed from monthly issues of: *Poultry-Canned and Processed Foods, Eviscerated-Federal Inspection*, U.S.D.A., AMS.

† Source: *Livestock Slaughter, by States*, September 1953, U.S.D.A., Crop Reporting Board, and monthly issues of *Livestock Slaughter and Meat Production*, U.S.D.A., Crop Reporting Board.

‡ Ready-to-cook weight.

accounted for much of the increase in poultry used in all canned and other processed foods.

Since the yield or quantity of cooked poultry meat obtained is an important factor in this industry, it utilizes mainly cocks, hens, and some turkeys. Broilers and fryers are seldom used because of the lower yields of cooked meat.

The location of the industry is predominantly in the areas where the kind of poultry needed is available for its use. Although there may be some firms that prepare these products without U.S. Department of Agriculture inspection, the information available on plants operating

under supervision of the Poultry Inspection Branch of the U.S. Department of Agriculture gives an indication of the location of the industry. The Middle Atlantic States rank first with 46 plants, the East North Central States rank second with 43 plants, and the West North Central States rank third with 39 plants (Table 20).

Basically, the following operations are performed in the preparation of these foods: (1) eviscerating the dressed poultry, (2) cooking the eviscerated poultry under pressure (similar to using a pressure cooker at home, but on a larger scale), (3) removal of the edible meat and skin from the bones, (4) packing the meat in metal or glass containers, or combining the meat with other foods and seasonings, (5) sealing and pasteurizing if the poultry is to be canned, or baking and/or freezing if it is for pot pies or other such products, (6) applying labels, and (7) packing. The broth, a by-product of the cooking operation, is canned and sold.

NONFOOD BY-PRODUCTS

Feathers

The story of the feather industry begins when the feathers are plucked from the birds and ends when they are used in pillows, bedding, furniture, hats, feeds, or fertilizer. It is an industry that is plagued with both chronic surpluses and shortages. There are two distinct types of feathers, so far as their value and potential uses are concerned: (1) feathers for bedding, and (2) feathers for feed and fertilizer.

Feathers for Bedding. Ducks and geese are the main source of feathers for bedding. They are used in the manufacture of bedding and furniture, and during wartime they become a critical material for use in sleeping bags and aviator's jackets. They are used also in the millinery trade, in feather dusters, fishing tackle, shuttlecocks, and other products.

The down and small body feathers have the greatest value because of their high bulking and insulation qualities. Large body feathers and quills are the least valuable. Historically, the demand for waterfowl feathers has exceeded domestic supply. Because demand has exceeded supply, large quantities of duck and goose feathers have been imported from Far Eastern countries. However, in recent years the use of foam rubber in furniture manufacture has decreased the demand for waterfowl feathers.

Table 20. Poultry Canning Plants in the United States *

State and Region	Number of Plants	State and Region	Number of Plants
Maine	3	South Carolina	1
New Hampshire	1	Georgia	5
Vermont	...	Florida	...
Massachusetts	6		—
Rhode Island	...	<i>South Atlantic</i>	24
Connecticut	4	Kentucky	1
	—	Tennessee	2
<i>New England</i>	14	Alabama	1
New York	21	Mississippi	1
New Jersey	12		—
Pennsylvania	13	<i>East South Central</i>	5
	—	Arkansas	4
<i>Middle Atlantic</i>	46	Louisiana	...
Ohio	7	Oklahoma	...
Indiana	5	Texas	3
Illinois	26		—
Michigan	2	<i>West South Central</i>	7
Wisconsin	3	Montana	1
	—	Idaho	...
<i>East North Central</i>	43	Wyoming	...
Minnesota	12	Colorado	...
Iowa	9	New Mexico	...
Missouri	7	Arizona	...
North Dakota	...	Utah	1
South Dakota	...	Nevada	...
Nebraska	11		—
Kansas	...	<i>Mountain</i>	2
	—	Washington	2
<i>West North Central</i>	39	Oregon	3
District of Columbia	1	California	27
Delaware	4		—
Maryland	6	<i>Pacific</i>	32
Virginia	6		—
West Virginia	1	<i>U.S. Total</i>	212
North Carolina	...		—

* Supervised by the Poultry Inspection Branch, U.S.D.A., May 1959.

It was reported that poultry processing plants obtained 95 cents to \$2.50 per pound, with an average of \$1.00 per pound, for waterfowl feathers in 1955.⁴⁰ Since it takes only 7 ducks or 5 geese to produce 1 pound of feathers, it can be seen readily that the revenue from the feathers may offset part or all of the cost of processing the poultry.

Many operations are performed in the handling of waterfowl feathers because of their relatively high value. The operations include (1) washing with soap and water, (2) drying, (3) dusting to remove dirt and foreign matter, (4) sorting for size by blowing them over baffles, and (5) storage until used in manufacturing. The quills are put through an attrition mill which breaks them up to be used for other purposes.

Feathers for feed or fertilizer. Chicken and turkey feathers are not well suited for bedding and allied uses. The large volume of feathers resulting from the slaughter of chickens and turkeys, therefore, has presented a challenge to processors to find an economic use or outlet. In small slaughtering plants the quantity available is not sufficient to merit storing, drying, or sorting operations. Chicken and turkey feathers are used mainly as fertilizer (they have a high nitrogen content) and in feed. Hackle and tail feathers are used in fishing tackle and millinery manufacture. Some feathers have also been exported to the Balkan countries, but the amount has been relatively small. A considerable quantity of hackle feathers are imported, particularly for flytying.

Historically, the supply of chicken and turkey feathers has greatly exceeded demand. Because supply has exceeded demand their price has been low, and disposal of the feathers has presented a problem. Many processing plants have found it necessary to haul them away and dump them. Some plants have found farmers who are willing to come and get the feathers to spread on their land. Some plants have been able to sell them for \$2 to \$4 per ton. Since it takes about 10 broilers, 6 fowl, or 5 mature turkeys to produce 1 pound of feathers, it can be seen that the revenue from them is not sufficient to offset the costs of processing the poultry. Renderers provided the outlet for feathers from 95 per cent of the commercial plants (those slaughtering more than 30,000 pounds live weight per week while in operation) in 1955.⁴⁰ The outlets used by small volume plants in 1955 were renderers, 29 per cent; farmers, 27 per cent; dump, 36 per cent; and other, 8 per cent.

The relatively low value of chicken and turkey feathers limits the amount of effort that can be expended in rendering or other opera-

tions. In fact the quantities available have to become quite large before it becomes profitable to render them.

Briefly, the operations performed in the production of feathermeal or "hydrolized" poultry feathers are: (1) collecting the feathers, (2) temporary storage, (3) cooking, (4) drying (Fig. 56), (5) grinding, and (6) bagging. The wet feathers must be cooked at high pressure (40 to 60 pounds per square inch, or 287° to 307° F) for 30 to 60 minutes and then dried under a vacuum or in a rotary steam tube drier. This process breaks down the feathers into a granular meal and makes them digestible for feeding to animals. The feathermeal, after grinding, weighs 52 to 60 pounds per cubic foot, and it contains 12.1 to 13.6 per cent nitrogen. It can be used as either feed or fertilizer.

Blood and Offal

Poultry offal consists of the blood, head, feet, viscera, lungs, kidneys, oil sac, and any other parts of the bird usually considered inedible. Feathers are sometimes included in the term, but more generally they are not. The heart, gizzard, and liver are considered edible by most people and are not usually included in the term. The feet are sometimes considered edible. Where sufficient quantities are available, the major use for blood and offal is by renderers who cook it to obtain blood meal, meat scrap, and inedible grease. Offal is also used as feed for hogs and fur-bearing animals such as mink, cats, and dogs, and by fish hatcheries for the feeding of fish. Cooking of the offal for feeding is desirable, and it is required by law in many states.

In small plants the offal available from poultry dressing and eviscerating operations presents a problem of waste disposal. In large plants sufficient quantities may be available to justify rendering operations.

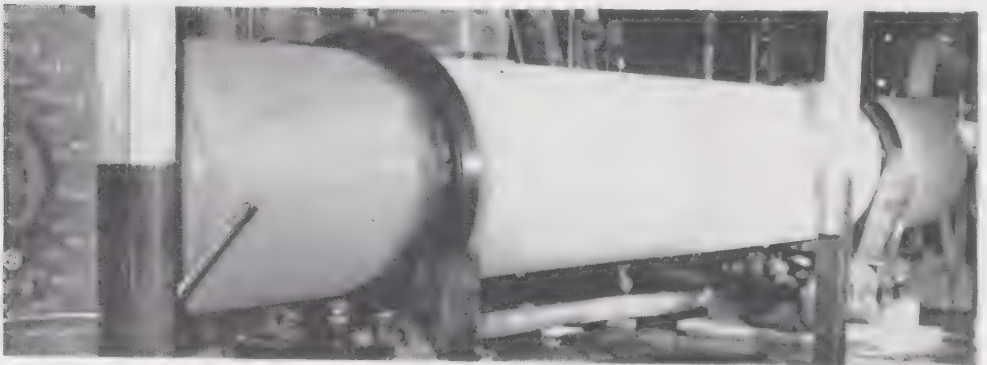


Fig. 56. Type of dryer used for preparing feathermeal. (U.S.D.A., AMS)

or a rendering firm in the area may be able to pay the poultry processing plant for it.

Because costs of rendering blood and offal are high in relation to its value as a feedstuff or fertilizer, the price paid for blood and offal has been low. In fact, poultry processors in some areas have had to incur disposal costs to haul and dump it. Payments made by the rendering companies, hog farmers, and other buyers varied in 1955 from 10 to 65 cents per hundredweight for raw offal. A few poultry slaughterers who sold offal to fur farmers received 75 cents or more per hundredweight for select offal, consisting of heads and feet from poultry free from hormone treatment.⁴⁰ In contrast, slaughterers who had offal removed to town dumps or municipal incinerators paid the disposal costs which ranged from 12 to 30 cents per hundredweight.

The yield of offal varies depending upon class of poultry, breed, age, finish, and other factors. For turkeys it may be less than 15 per cent of the live weight, whereas for broilers it may exceed 20 per cent. Yields also vary depending upon practices followed in the slaughtering and rendering plant, but the data in Table 21 are believed to be typical for poultry having a ready-to-cook yield of 70–72 per cent of the live weight.⁵³

Proximity to a renderer or an offal pickup route, plus the volume available, are important factors in determining what, if any, price the renderer will pay for the raw offal. The outlets used by commercial poultry slaughterers in 1955 were: renderers, 96 per cent, and farmers, 4 per cent. In contrast, the outlets used by small volume poultry slaughterers were: renderers, 58 per cent, farmers, 21 per cent, and dump, 21 per cent. The low value of offal limits the amount of effort that can be expended in rendering operations.

The operations performed in handling offal are: (1) collecting the offal, either by manual methods or by use of a flow-away system (in which the offal moves through troughs filled with water and is discharged through a rotary screen where the free water is removed), (2) temporary storage in drums, (3) transportation to a rendering operation, (4) cooking to remove the moisture, (5) pressing to remove the grease from the meat scrap (Fig. 57), (6) grinding the meat scrap, and (7) bagging. The grease is collected at the press and stored in drums until shipped.

Utilization of By-products and Disposal of Wastes

As the size of plant operations is increased, when does it become feasible for the poultry processor to install rendering equipment, when does it become necessary to install a waste disposal system, and what

Table 21. Estimated Waste and Nonfood By-Product Yields for Broilers, Fowl, and Turkeys

	Offal	Blood	Feathers	Total Mixed
Per 100 pounds of live broilers				
Waste yield	17.5	3.5	7.0	28.0
Water pickup *	1.0	...	15.0	16.0
Total Waste	18.5	3.5	22.0	44.0
Dry product yield (8% water)	5.8	0.78	5.5	12.1
Pressed product (10% fat)	5.16			
Fat	0.64			
Per 100 pounds of live fowl				
Waste yield	17.0	3.0	7.0	†
Water pickup *	1.0	...	13.0	†
Total waste	18.0	3.0	20.0	†
Dry product yield (8% water)	7.4	0.67	5.5	†
Pressed product (10% fat)	4.27			
Fat	3.17			
Per 100 pounds of live turkeys (15 pounds each)				
Waste yield	12.5	3.5	7.0	23.0
Water pickup *	...	...	7.0	7.0
Total waste	12.5	3.5	14.0	30.0
Dry product yield (8% water)	5.0	0.78	5.9	11.7
Pressed product	4.17			
Fat	0.83			

* Varies with plant practices.

† No advantage in mixing, since the fat content is too great to permit grinding without pressing.

Source: Adapted from Tables 1-3 in "Processing Poultry By-Products in Poultry Slaughtering Plants."⁵³

is the lowest cost system to install? These questions will be treated rather briefly in the following sections, and it is recommended that those who desire more information on these subjects read the references, and the Supplementary Reading list at the end of this chapter.

Rendering. A technical economic study has been made of rendering processes for the conversion of poultry wastes into by-products suitable for animal feeds.⁵³ It resulted in the following

general conclusions concerning the feasibility of rendering plants integrated with slaughtering operations:

1. At slaughtering volumes under 100,000 pounds of live weight per week, the losses involved in operating a rendering plant would seem to exceed the costs incurred at present by a slaughterer in merely getting rid of his wastes by some other method.
2. At slaughtering volumes between 100,000 and 300,000 pounds of live weight per week, a rendering operation may cost no more (and possibly less) than current disposal procedures.
3. At slaughtering volumes in excess of 300,000 pounds of live weight per week, profitable operation of integrated rendering plants appears possible, with returns on investment becoming fairly attractive when the 500,000 pound mark is passed.
4. Extraction of fat, or the production of blood meal, appears impractical at slaughtering volumes below approximately one million pounds live weight per week.
5. Production of mixed meal from the combined wastes from a



Fig. 57. Removing pressed cake from hydraulic press. (U.S.D.A., AMS.)

slaughtering plant appears to be the most attractive procedure, provided that a market exists or can be developed for this material.

6. The exact solution to the waste problems of slaughterers in a given region will depend on a number of local factors that should be studied in each case before a final decision is made.

7. Utilization of a dryer in conjunction with cookers rather than cookers alone can be more profitable in the case of producing feather-meal (Fig. 56).

Disposal of wastes. Water in large quantities is essential to the processing of poultry. Waste water from poultry slaughtering plants contains various quantities of manure, blood, feathers, fleshings, and other organic material. Even when the major portion of the feathers and offal are excluded or removed by use of a screen, a certain amount of these materials is carried in the waste water. The strength of the waste water, in terms of its solids content and biochemical oxygen demand (B.O.D.), depends upon the waste materials which go into the sewers. Many plants include blood in sewage, and a few plants include manure or both blood and manure, but this latter practice is decreasing. When both blood and manure are excluded, stream pollution is held to a minimum.⁴⁰

In deciding how to dispose of blood and manure, the plant manager should consider, (1) local health or stream pollution regulations or conditions imposed by local authorities who provide sewer service, (2) whether the use of the sewer will be more desirable than other methods of disposal, and (3) the tendency of manure to fill the sewers with sediment. Waste water can be disposed of through a spray irrigation system⁶⁹ or a tile field, when a stream or city sewer is not available. The field methods require a considerable area of soil, however, and the soil must be permeable and suited to sewage disposal. Spray irrigation systems have been used successfully with canning plant wastes and may offer a practical solution to the problem of waste disposal of large poultry processing plants.

If all alternatives are available, the preference in terms of costs, probably would be as follows: (1) discharge into open streams, if permitted by public authorities, (2) use of municipal sewers, (3) use of spray irrigation, (4) use of tile fields, (5) use of recirculating filter before discharge into stream, (6) use of single-cycle filter before discharge into stream.

Questions

1. Visit a supermarket and an independently operated grocery store, and list the canned and processed poultry products offered for sale. Note the point of origin as indicated by the labels.
2. How many ducks, geese, broilers, turkeys, and fowl are necessary to yield one pound of dry feathers?
3. Visit a processing plant, and find out what means are utilized for disposal of feathers and offal.
4. In what ways has raw offal been utilized, and what precautions must be taken when it is fed to certain animals?
5. How many pounds of raw offal can be expected when 10,000 broilers averaging $3\frac{1}{2}$ pounds each are slaughtered per day?
6. How many pounds of wet feathers must be removed from a plant processing 10,000 broilers per day?
7. What are some of the major problems that must be met with local officials in regard to waste disposal from a poultry processing plant?
8. What slaughtering volume is apparently necessary before a profitable rendering plant operation can be integrated with a processing operation, and why?

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Transporting and Storing Eggs and Poultry

Although farmers consume some of the eggs and poultry they produce, the bulk of these products is sold to various types of assemblers, shippers, storers, processors, retailers, or consumers. In most instances these handlers begin a chain of so-called "middlemen" who transport the farm products within easy accessibility of consumers. Through their services they smooth out the marketing season by storing the products which are produced in surplus at one season and then returning them to the market at another season, when they are produced scantily. Every time that someone in the marketing chain of handlers between the farmer and consumer performs a service, it adds an increment of economic value to the product. By transporting, by storing the product, or by changing its form he is making the product more desirable to the consumer.

Most of the preceding chapters were concerned with changing the form of the products and related problems. The discussion in this chapter is concerned with the utility added by place, or transportation, and the utility added by time, or storage.

TRANSPORTATION OF EGGS AND POULTRY

Transportation is an important marketing function because the bulk of the eggs and poultry is produced at considerable distances from heavily populated cities. Any improvement of transportation services and reduction in transportation costs helps to increase the number of markets available to the producers and the supply of products available to the consumer. It also makes possible the concentrations of urban population long distances from the food sources, helps to stabilize prices, and has contributed to economic growth in many other ways.

Without railroads to transport products from the Middle West to

the East and manufactured goods from the East to the Middle West, the very rapid population expansion during the latter part of the nineteenth century and the early part of the twentieth century would not have been possible. Since 1904, however, the first year in which there were motor truck registrations in the United States, the truck has come to occupy a major position in the transportation of eggs and poultry. Shorter transit time on some movements and greater flexibility in pickup and delivery are probably the most important factors accounting for the rapidly increasing use of trucks. This is particularly true of perishable commodities. Long distance trucking has developed rapidly since the 1930's.

The free flow of poultry and eggs from one place to another helps to reduce the location disadvantage suffered by some producers and helps to equalize supplies and increase consumption of the products by aiding the movement from surplus production areas to deficit areas.

Importance of Various Kinds of Transportation

Railroads and more recently motor trucks are used for transporting the bulk of the poultry and eggs from producers to consumers. Relatively small amounts are transported by boat or airplane.

At the four markets of New York City, Chicago, Philadelphia, and Boston, the receipts of live poultry are now almost entirely by truck (Table 22a). Receipts of processed poultry were predominantly by rail during the period 1942-1946, but now the position has been reversed. Receipts at the four markets were 92 per cent truck and 8 per cent rail during the period 1954-1958. This trend was probably hastened by the shift in the slaughtering of poultry from city plants to country plants. By processing at country points a large portion of the inedible part of the bird (blood, feathers, viscera, head, and feet) is removed prior to shipping. In this way a significant reduction in the shipping weight and transportation cost is made.

Receipts of shell eggs at the four markets were 56 per cent by rail and 44 per cent by truck just prior to World War II. This position was reversed toward the end of the war, and at present almost all of the receipts are by truck. The shift from rail to truck for frozen eggs has proceeded at a slower rate than for shell eggs. However, the same shift is apparent and during the 1954-1958 period 94 per cent of the receipts of frozen eggs were by truck. Several factors apparently have contributed to the shift from railroad to truck transportation. Truck transportation has reduced the average transit time from shipper to receiver; this reduction has lessened the ever present risk of price change. Loss in transit and quality deterioration, especially for shell eggs, has been lower in truck shipments. Railroad shippers and re-

Table 22a. Truck and Rail Receipts, at New York, Chicago, Philadelphia, and Boston, 1939-1941, 1942-1946, 1947-1951, and 1954-1958

Product and Kind of Transportation	1939-41	1942-46	1947-51	1954-58
<i>Per Cent</i>				
Live poultry				
Truck	78 *	84	97	99
Railroad	22 *	16	3	1
Processed poultry				
Truck	‡	30 §	67	92
Railroad	‡	70 §	33	8
Shell eggs				
Truck	44	48	73	100
Railroad	56	52	27	†
Frozen eggs				
Truck	‡	9 §	43	94
Railroad	‡	91 §	57	6

* Based on New York City and Chicago only.

† Less than one-half of one per cent.

‡ Not available.

§ Based on 1944-1946.

Source: Computed from data in *Dairy and Poultry Market Statistics* U.S.D.A., AMS annual reports, 1939-1958.

ceivers without railroad sidings have to transport the products to or from railroad team tracks or sidings. This additional cost of moving the products (cartage) can usually be eliminated when motor trucks are used. Truckers have been able to exercise more flexibility in their rates, time, and routes. In some instances, flexibility has been increased by the inclusion of some special services (such as refrigeration or heating, help for loading and unloading), without full charge—services which the railroads could not provide under their tariff regulations.

Major Transportation Movements

Transportation occurs at every stage in marketing, but the major movements of the bulk of the products are from areas of surplus production to areas of concentrated population.

Eggs. Although eggs move to market from farms in every state, the large-scale movement is from the Midwestern States to consuming

Commercial broilers. The major movements of commercial broilers are from the concentrated production areas of Southern Maine, the Delmarva peninsula, Shenandoah Valley of Virginia, North Carolina, North Georgia, Alabama, Mississippi, Northwestern Arkansas, and Texas to consuming markets in the Northeast, Lakes States, and California (Fig. 58, Table 22*c*).

Turkeys. The major movement of turkeys is quite different from eggs or commercial broilers. Turkeys are produced heavily in the Western and Midwestern States and in Texas. The bulk of the movement is to markets in the Northeast and Great Lakes States (Table 22*d*).

Country pick-up truck routes. Live poultry and shell eggs are often picked up on truck routes at the farm, at country buying stations, and country stores. Although the relative proportions vary between differ-

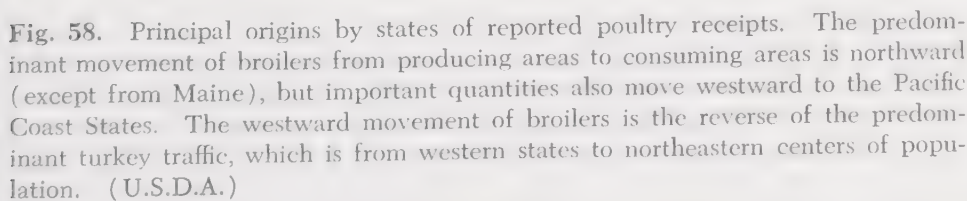


Table 22b. Shell Eggs: Total Receipts, by Cities, and by Origin, 1958⁸⁸

(Cases, in thousands)

Origin	Atlanta	Balti- more	Boston	Chicago	Cincin- nati	Cleve- land	Detroit	Los Angeles	New York	Phila- delphia	Pitts- burgh	Port- land	St. Louis	San Francisco
Arkansas	...	...	...	...	...	...	...	...	...	...	...	...	0.6	...
California	...	...	...	0.5	...	...	...	2,879.2	...	...	...	9.9	...	1,303.2
Colorado	...	...	...	...	...	...	...	...	...	...	...	...	...	1.6
Connecticut	...	...	80.6	...	...	...	...	...	46.8	...	...	...	...	...
Delaware	...	1.5	...	...	...	...	...	...	1.7	4.4	...	...	...	...
Florida	...	...	...	0.3	...	...	...	...	...	...	...	...	...	...
Georgia	314.1	10.6	...	...	...	...	...	...	2.1	0.8	0.5	...	...	...
Idaho	...	...	...	...	...	...	...	...	...	...	...	0.8	...	...
Illinois	13.4	1.3	8.2	589.9	16.7	21.4	31.4	...	31.2	91.7	4.8	...	401.3	...
Indiana	...	1.6	...	99.1	296.7	24.3	132.8	...	91.3	...	110.0	...	...	...
Iowa	282.4	340.5	113.4	645.1	6.0	53.4	188.8	13.6	1,703.5	165.3	150.3	...	114.3	21.6
Kansas	...	...	31.4	1.1	...	0.9	0.6	1.2	3.0	...	...	...	2.2	31.7
Kentucky	...	...	...	...	28.8	...	...	...	...	8.1	...	...	...	...
Maine	...	...	514.1	...	...	...	...	...	0.7	...	...	...	...	...
Maryland	...	99.3	...	...	...	...	...	...	0.8	19.1	7.2	...	...	...
Massachusetts	...	...	346.4	...	...	...	...	...	24.0	...	...	...	...	...
Michigan	...	3.2	1.6	19.3	0.3	2.9	526.2	...	3.1	3.0	0.5	...	...	...
Minnesota	37.1	355.2	14.8	762.5	9.2	108.1	292.3	33.0	1,041.7	53.8	196.0	7.3	6.0	2.4
Missouri	...	...	...	2.4	1.8	...	...	...	3.6	0.7	...	...	302.4	...
Nebraska	...	7.7	...	29.3	5.3	6.0	1.9	1.2	82.9	7.6	...	...	1.8	0.6
New Hampshire	...	...	279.1	...	...	...	...	...	9.1	...	...	...	...	...

New Jersey	2.1	14.8	...	...	...	...	...	...	1,028.5	209.9	...	...	...	...
New York	...	3.1	71.6	...	...	0.5	...	...	547.2	0.4	...	...	...	...
North Carolina	...	13.4	...	...	...	...	...	...	17.6	0.7	...	...	...	...
North Dakota	...	0.6	...	...	0.7	...	...	...	...	0.6	...	...	...	...
Ohio	...	1.9	...	...	2.5	145.4	454.1	524.0	21.7	6.1	369.2	...	...	...
Oklahoma	...	...	...	...	...	...	...	...	...	...	...	1.3	...	...
Oregon	...	...	...	...	...	...	...	...	...	...	361.8	...	...	...
Pennsylvania	...	288.0	...	...	0.6	...	...	...	535.1	861.5	36.8	...	...	...
Rhode Island	...	...	3.6	...	...	...	...	...	6.2	...	...	...	...	...
South Carolina	0.1	...	...	...	...	...	...	...	1.5	0.5	...	...	...	...
South Dakota	1.1	4.0	...	...	86.4	...	...	0.8	109.7	2.9	0.8	0.1	...	0.6
Tennessee	0.1	...	...	...	...	...	...	...	...	3.3	...	...	...	...
Utah	...	...	...	...	...	...	...	...	...	...	...	0.1	...	1.2
Vermont	...	...	17.4	...	...	...	...	...	...	...	...	...	...	...
Virginia	...	16.6	...	...	...	2.5	...	...	18.9	0.5	...	...	...	...
Washington	...	...	...	...	...	...	...	...	...	...	...	36.3	...	0.4
West Virginia	...	0.5	...	...	...	...	...	...	...	...	0.5	...	...	...
Wisconsin	0.6	2.6	...	...	995.8	2.7	19.3	117.9	2.9	1.2	0.1	...	...	...
Canada	...	...	...	...	...	...	...	3.1	4.9	...	...	...	...	...
Denmark	...	...	...	...	...	...	...	...	1.4	...	...	...	...	...
Total 1958	651.6	1,166.4	1,482.2	3,235.5	515.4	691.2	1,819.8	2,953.6	5,341.1	1,442.1	867.7	416.3	889.9	1,363.3
Total 1957	706.3	1,021.5	1,438.3	3,400.7	528.3	724.9	1,859.7	2,630.6	4,779.6	1,301.4	807.4	427.0	966.3	667.5

Source: Dairy and Poultry Market Statistics, 1958, U.S.D.A., AMS, May 1959.

Table 22c. Processed Poultry Other Than Turkeys: Total Receipts, by Cities, and by Origin, 1958⁸⁸

(Pounds, in thousands)

Origin	Atlanta	Boston	Chicago	Cleveland	Detroit	Los Angeles	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco
Alabama	28	...	13,294	3,094	17,069	37,134	1,508	...	238	8,440	390
Arizona	...	...	86	...	...	...	...	...	...	...	...
Arkansas	...	...	6,196	104	222	12,733	129	...	118	20,262	2,762
California	...	...	653	...	...	1,029	...	...	...	...	10,482
Colorado	...	...	70	...	...	...	103	...	...	...	21
Connecticut	...	1,677	1	...	...	...	26,860	...	18	...	9
Delaware	...	6,897	22	...	...	...	50,988	20,471	87	...	1
Georgia	4,114	200	91,253	18,795	40,231	12,380	15,430	182	3,382	9,513	2,665
Idaho	...	...	...	...	...	...	...	...	...	...	18
Illinois	...	...	8,545	146	119	...	301	...	273	187	48
Indiana	...	33	11,744	847	1,320	...	64	...	1,210	...	...
Iowa	...	58	4,598	176	...	183	614	...	180	57	34
Kansas	...	...	186	...	...	1,000	105	...	...	...	49
Kentucky	...	34	11,736	2,535	1,461	...	...	...	809	21	...
Louisiana	...	...	5	...	...	1,680	...	...	...	...	1,144
Maine	...	20,063	97	...	186	...	60,110	...	47	...	...
Maryland	...	1,305	131	1,166	316	...	52,033	18,302	3,122	...	52
Massachusetts	...	6,194	49	20	75	...	4,449	...	...	...	...
Michigan	15	...	954	188	770	...	...	...	67	30	...
Minnesota	...	59	1,557	153	58	256	284	62	86	32	23

Mississippi	...	...	2,456	...	3,587	14,381	...	...	42	9,396	4,795
Missouri	5	74	5,844	31	...	362	144	...	56	6,913	45
Nebraska	...	27	1,160	155	...	648	698	...	...	...	113
New Hampshire	...	4,865	31	...	...	...	6,198	...	...	...	...
New Jersey	...	...	85	...	...	...	268	2,055	...	...	...
New Mexico	...	...	115	31	...	...	...	...	...	...	...
New York	...	35	1,078	236	27	222	5,204	190	201	...	316
North Carolina	18	2,747	3,691	57	5,231	190	24,872	8,965	7,836	...	...
North Dakota	...	...	83	55	...	...	13	...	...	...	...
Ohio	...	...	895	9,011	453	...	...	7	3,491	...	...
Oklahoma	...	...	394	...	...	520	1	...	...	...	203
Oregon	...	...	...	...	...	...	...	...	...	...	66
Pennsylvania	...	3,248	238	7,167	168	...	18,474	5,723	12,092	...	...
Rhode Island	...	3,341	...	...	...	...	670	...	...	...	...
South Carolina	...	28	72	...	...	35	1,879	1,410	137	...	...
South Dakota	...	...	227	...	...	...	...	...	...	...	23
Tennessee	...	...	12,307	2,439	10,999	...	1,117	18	1,659	2,677	...
Texas	...	...	226	...	...	4,367	...	...	...	...	993
Utah	...	...	...	43	...	...	116	...	...	...	278
Vermont	...	937	...	...	...	...	38	...	...	...	...
Virginia	...	683	171	139	211	...	2,410	6,453	1,122	...	388
Washington	...	...	27	...	...	...	...	...	...	...	...
West Virginia	...	...	...	...	5	...	775	...	2,215	...	...
Wisconsin	...	...	6,727	...	...	...	112	...	...	...	...
Total 1958	4,180	52,505	187,204	46,588	82,508	87,120	275,967	63,838	38,488	57,528	24,918
Total 1957	3,807	52,186	131,226	45,246	69,953	70,702	290,629	67,023	34,278	48,897	26,440

Source: *Dairy and Poultry Market Statistics, 1958, U.S.D.A., AMS, May 1959.*

Table 22d. Processed Turkeys: Total Receipts, by Cities, and by Origin, 1958⁸⁸

(Pounds, in thousands)

Origin	Atlanta	Boston	Chicago	Cleveland	Detroit	Los Angeles	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco
Arkansas	...	52	971	...	154	15	449	1,013	34	127	...
California	893	3,406	2,824	27	203	48,789	15,875	1,387	141	1,230	11,571
Colorado	...	...	373	...	27	...	3,079	600	46	27	...
Connecticut	...	...	...	...	...	...	12	...	...	...	...
Delaware	...	406	...	...	...	...	496	28	...	...	...
Florida	...	...	...	...	...	...	49	...	...	...	...
Georgia	66	51	130	2	...	...	59	...	...	...	...
Idaho	...	...	80	...	...	...	...	50	...	...	...
Illinois	34	628	3,115	441	2,675	...	1,600	2,117	323	25	...
Indiana	30	725	482	795	1,165	...	923	1,460	511	177	...
Iowa	91	4,150	9,428	498	703	...	6,326	3,013	395	674	...
Kansas	189	455	1,509	...	84	...	363	...	112	437	...
Kentucky	...	62	102	...	276	...	100	86	417	28	...
Maine	...	485	...	...	...	...	139	...	...	...	...
Maryland	...	121	24	...	...	...	499	...	22	...	...
Massachusetts	...	669	...	...	...	...	127	...	...	...	...
Michigan	...	...	255	135	1,058	...	58	180	251	3	...
Minnesota	377	6,167	16,148	57	954	...	5,098	3,992	1,444	226	...
Missouri	25	1,508	2,298	...	322	...	3,506	682	401	2,067	...
Nebraska	175	476	1,472	176	70	76	3,199	533	85	764	...

New Hampshire	...	102	...	...	...	...	85	...	...	...	...
New Jersey	...	...	...	...	...	...	108	19	...	...	...
New York	...	41	...	...	232	...	337	30	...	...	...
North Carolina	55	376	94	...	...	...	1,945	335	737	...	...
North Dakota	...	111	...	...	...	...	122	93	...	...	...
Ohio	...	115	107	...	2,232	...	87	371	2,765	...	...
Oklahoma	30	169	385	...	...	48	179	...	...	183	...
Oregon	...	52	34	...	...	78	239	32	...	...	...
Pennsylvania	...	205	53	112	...	...	1,308	534	944	...	...
Rhode Island	...	18	...	...	...	...	...	...	...	...	...
South Carolina	...	...	...	...	...	...	850	...	36	...	...
South Dakota	...	...	1,313	...	...	...	...	61	41	...	...
Tennessee	...	70	169	...	...	...	43	...	24	...	...
Texas	91	204	2,565	...	...	...	438	...	...	639	...
Utah	215	1,532	4,360	...	...	455	8,298	686	251	...	26
Vermont	...	55	...	...	...	...	93	...	...	...	...
Virginia	95	60	84	...	...	25	6,759	922	889	...	...
Washington	...	...	85	...	...	82	...	150	...	...	...
West Virginia	...	...	...	13	...	...	...	...	71	...	...
Wisconsin	...	703	9,084	...	...	55	399	132	64	31	...
Wyoming	...	10	...	...	...	...	...	...	...	...	...
Canada	...	...	...	...	...	1	...	...	...	...	...
Total 1958	2,366	23,184	58,102	4,488	9,174	49,004	63,247	18,506	10,004	6,638	11,597
Total 1957	1,312	23,775	51,895	4,547	6,658	(*)	75,860	18,735	12,318	7,246	11,953

* Not available.
Source: *Dairy and Poultry Market Statistics, 1958, U.S.D.A. AMS, May 1959.*

ent states and regions, a study in Indiana⁷⁰ showed that more than three-fourths of the total volume of poultry and eggs picked up on truck routes was obtained at farm stops and the remainder at buying stations and stores.

Although stake-type trucks of about 1-ton capacity are still used for collecting poultry and eggs in the country, insulated van-type trucks are coming into use when only eggs are collected. In commercial egg production areas, refrigerated trucks are being used more and more to conserve the egg quality.

Over-the-road tractor-trailer trucks. Eggs and processed poultry are shipped long distances from country assemblers to wholesale receivers by tractor-trailer combinations. These trucks usually carry 600 cases of eggs or 30,000 pounds of poultry (Fig. 59).

Many of these truck-trailers are made with aluminum or stainless steel outside sheathing that covers a well-insulated body. Various types of insulation are used as, for example, 4 inches of fiber-glass in the roof, 3 inches at the sides and ends, and 1½ inches or more in the floor. Interior equipment for shipping eggs or frozen poultry usually consists of floor racks, side wall strips, and an air duct on the ceiling to promote adequate air circulation through and around the load (Fig. 60). Fresh poultry is ordinarily packed in containers with ice and crushed ice is blown over the load, so the air duct is not necessary.

Railroad refrigerator cars. The 40-ton general purpose railroad refrigerator car is standard equipment for long hauls of perishable



Fig. 59. Tractor-trailer truck for long hauls of poultry and eggs. Many of these trucks are equipped with mechanical refrigeration systems. These carry payloads of up to 40,000 pounds.



Fig. 60. Interior of a truck trailer equipped with adequate floor racks, side-wall strips, and air duct on ceiling of trailer. All three of these desirable features are for the purpose of promoting adequate air circulation through and around the load. (U.S.D.A.)

agricultural commodities (Fig. 61). Many of these cars have heavy insulation and false inner walls of plywood to allow cool air to circulate around the load. Since the early days, many improvements have been made, including better springs, shock-cushioning underframes, mechanical refrigeration, and forced air circulation (Fig. 62).

City delivery trucks. A wide variety of trucks is used for city delivery, ranging in size and type from 1-ton stake-type trucks to refrigerated vans holding many tons. With the growth of supermarkets more large trucks are used for city distribution.

Preparing and Loading Vehicles

The interior of the body of the truck or car should be thoroughly cleaned. Shell eggs readily absorb odors.³⁷

Precooling and preheating vehicles. During warm weather it is necessary to precool the vehicle before poultry or eggs are loaded. Loading should be undertaken at as low a commodity temperature



Fig. 61. An ice-refrigerator railroad car. This car utilizes aluminum for covering to reflect radiant heat and reduce gross weight.

as possible, because these temperatures are apt to rise during transit in warm weather. Proper precooling temperatures depend on such factors as type of refrigeration used in vehicle, type of product to be carried, size of load, type and amount of insulation, air circulation in vehicle, and outside temperature. Desirable conditions to be maintained during transit are:

	<i>Temperature</i>	<i>Humidity</i>
Shell eggs	35° to 38° F	70%
Frozen eggs	0° F or less	
Dried eggs (egg solids)		
Albumen	75° F or less	
Yolks	50° F or less	
Chilled poultry	34° to 36° F	90 to 95%
Frozen poultry	0° F or less	

In a transportation test ³⁸ of one type of mechanical refrigeration unit in a motor truck-trailer, the average temperature inside the trailer dropped from 66° F to an average of minus 3° F in about 2 hours and

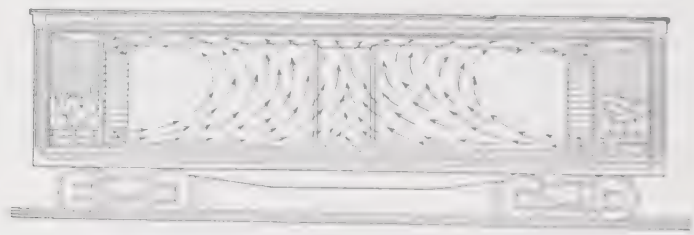


Fig. 62. Air circulation in a refrigerator car.

15 minutes, whereas the outside temperature ranged from 66° to 69° F. In another series of tests⁶⁵ railroad cars were precooled with water ice and 30 per cent salt about 36 hours prior to loading. The refrigerant was replenished 24 hours later. At the time of loading, the temperatures in the precooled cars were between 20° and 30° F.

During the winter months it is often necessary to preheat vehicles in which chilled poultry or shell eggs are to be shipped. The minimum safe temperature for shell eggs is 28° F.

Loading vehicles. A heavy curtain should be placed over the loading doorway of a vehicle which has been precooled or preheated, to maintain the inside temperature as much as possible while loading. Fiber boxes should not be loaded under wooden boxes. Straw, when packed tightly, as in the bale, makes an excellent buffer in railroad cars. Wooden bracing also may be used to take up lengthwise slack in the load (Fig. 63).

As most eggs to be shipped long distances have been precooled or have been in cold storage, and the product temperature is already close to the desired range, the cartons should be loaded together as tightly as possible.³⁷ Shell eggs are fragile and susceptible to breakage from vertical movement in the load. In truck trailers the load should

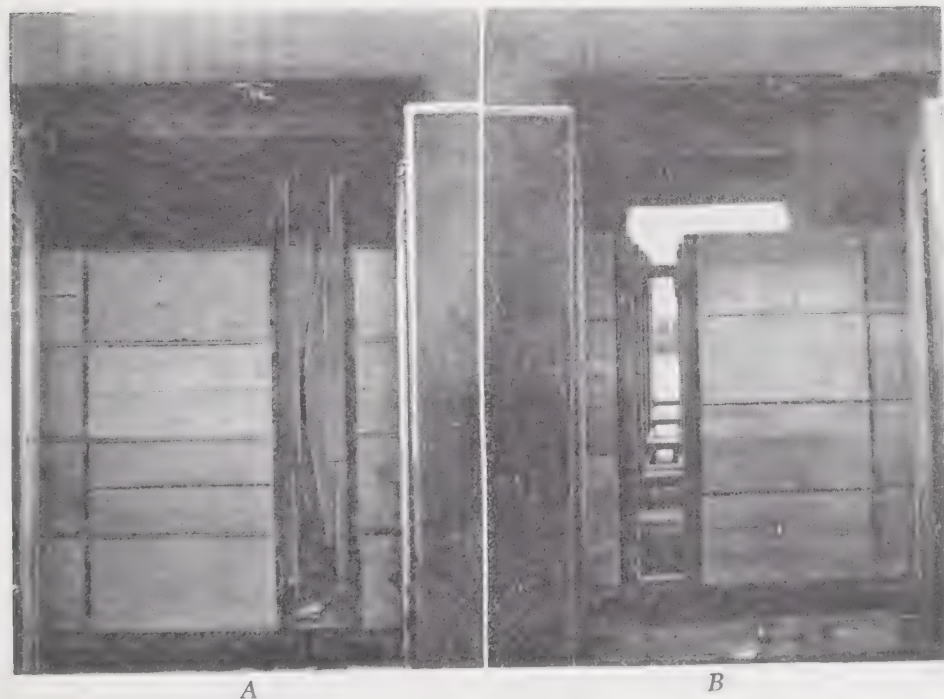


Fig. 63. Braces for safe rigid loading of eggs. A, Wedge type. B, Gate type.

be tied down in some manner to prevent this type of movement, particularly at the rear end over the axle area where the most severe vertical shocks occur. Extensive vertical movement of the load may be prevented by placing crosspieces of wood over the top layer cartons in each stack and securing them to the ceiling, floor, or side walls of the vehicle body. Inflated truck tire inner tubes are sometimes wedged tightly between the top of the load and the ceiling of the vehicle, with care, to avoid interfering with the air circulation.

Poultry packed in wirebound containers which do not have pronounced cover bulges may be loaded lengthwise, flat. Continuous vertical channels should be left between the rows of containers to accommodate crushed ice. If the truck or car walls do not have vertical strips, channels should be left between the outer rows of containers and the walls to accommodate the crushed ice to be added as the load is built up. After loading is completed, the top of the load should be covered with a blanket of crushed ice.

Refrigeration in Transit

Mechanical refrigeration. The advantages of mechanical refrigeration are controlled temperatures, ease of precooling and preheating, and elimination of icing. Some refrigerating units are made especially for motor trucks and some are designed especially for railroad cars. For motor trucks the engine, compressor, and other accessories can be located inside or outside the vehicle. These units usually range from 2 to 5 tons in capacity, depending on the type of vehicle and insulation and the kind of product to be transported.

A type of mechanical refrigeration unit, designed for railroad cars is called a "refrigeration package." It is rolled into a compartment at one end of the car. The "package" occupies the space of only one of the ice bunkers, which permits 16 per cent more cargo to be loaded. The refrigeration package can also serve as a heating unit when needed.

When refrigeration is supplied from only one end of the vehicle body, some shippers drop a canvas curtain in the middle. The end of the body that is nearer the refrigeration unit is kept at 0° F or lower for frozen products, whereas in the other half of the body a higher temperature is maintained for chilled products (Fig. 61).

Water ice. Water ice was first used in railroad freight cars between 1850 and 1860. Natural air circulation from water-ice bunkers (Fig. 62) is still used, but in the newer railroad cars and in trucks fans are often employed to aid air circulation. A water-ice bunker is

ordinarily provided in the front part of the trailer when ice refrigeration is employed for trucks (Fig. 64). As mentioned before, crushed ice is usually blown on top of the load when transporting fresh chilled poultry.

When frozen products are transported, 20 to 30 per cent salt is combined with crushed ice in the bunkers to maintain temperatures of 15° to 20° F. When water ice is used, the fans circulate the air, and the problem of providing adequate humidity is met.

Railroads, assessing a charge for ice, salt, and switching in accordance with published tariffs, furnish ice for precooling the cars and provide icing facilities along the way. Trucking companies make similar arrangements.

Dry ice. Solidified carbon dioxide, called dry ice, is sometimes used alone or in combination with water ice as a refrigerant. Dry ice has the advantages of being compact and convenient to handle, but so far it has been too expensive for general use.

Transportation Services and Privileges

The following transportation services and privileges have been offered historically by the railroads, and the larger trucking concerns are also offering comparable services.

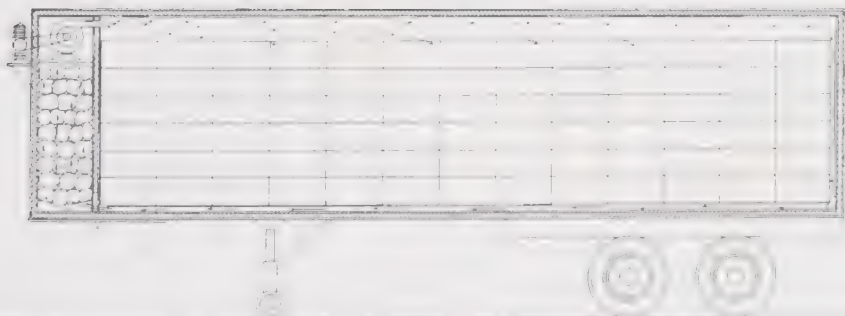
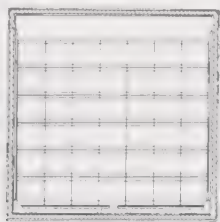


Fig. 64. End and side views of a load of 30-dozen fiberboard cartons of shell eggs, cooled by water ice with forced air circulation. (U.S.D.A.)

Express service. A fast express service including pick-up and delivery is employed, mostly for less-than-carload (L.C.L.) shipments for distances up to a few hundred miles, by the railroads through their subsidiary, the Railway Express Agency. Although it is expensive, some shippers use it regularly for small lots of eggs and poultry, and it is often useful in unusual instances, such as for anticipating falling markets or for late shipments before holidays. Certain trucking companies offer, in effect, what amounts to a similar fast express service.

Freight forwarding. At important shipping points a successful business of combining small shipments so that L.C.L. shippers gain the benefit of carload rates has sometimes been set up. These operators, called freight forwarders, are not so much needed since the more flexible truck movements are displacing the rail. Some producers and shippers act in a similar capacity by combining small lots of eggs and poultry to make full truckloads for shipment. Lower rates and better service are usually obtained thereby.

Concentration-in-transit. This is the privilege of assembling L.C.L. shipments at certain points from which they are loaded into a car with other L.C.L. lots, until the car is filled and is then considered a carload lot. When reshipped, the carload rate is charged from the point of origin to final destination, and refund is made for the L.C.L. charges previously paid. The same type of service is accomplished when eggs or poultry are brought to an assembly plant by trucks and reshipped in motor truck-trailers to the terminal market.

Stopping-in-transit-to-complete-loading. This privilege is of great assistance to shippers whose quantities are insufficient to ship full trucks or cars from a single point. Some carriers limit the number of stops permitted under this privilege.

Partial unloading. As a corollary to the stopping-in-transit-to-complete-loading privilege, trucks or cars may be partially unloaded at one point and then continue on to another destination for unloading the remainder. This privilege is of special benefit to receivers having branches in several cities, for they can unload part of a truck or car at each distributing point and obtain fresher supplies than would otherwise be possible.

Demurrage. Empty or loaded railroad cars may be held on track by either the shipper or consignee for a specified period of free time, usually about 48 hours. Penalties called demurrage charges are assessed for holding cars beyond the free time.

Diversion. By this privilege the destination of a railroad car or a motortruck may be changed en route. Most railroads permit only one change in destination for any single shipment.

Storage-in-transit. By this privilege eggs and processed poultry may be shipped by rail to a warehouse along the route between shipping point and destination, unloaded into the warehouse, and then, after the desired period of storage, reloaded and moved on to final destination. The one rate from the shipping point to destination is charged on such divided shipments.

Carrier's protective service. Under this service, the railroad assumes responsibility for protecting the commodities shipped against freezing, by installing heaters in the ice bunkers when outside weather conditions warrant. A small charge is made for the service.

Shipper's specified service. Upon request by the shipper, under this service carriers will furnish and install heaters in the cars. Shippers must specify at what outside temperature heaters are to be lighted and to be extinguished. Such shipments are transported at the owner's risk of damage by heat or cold if the damage is not the result of the carrier's negligence.

Icing instructions. Shippers have the privilege and duty of instructing the carrier when and how to ice the refrigerator cars or motor trucks in which they are shipping products.

Rates and Regulations

All common carriers subject to the Interstate Commerce Act must publish and file, with the Interstate Commerce Commission, tariffs containing every rate, regulation, service, and privilege incident to all commodities that they offer to transport. Such rates and rules as legally published are binding upon both the carriers and the shippers, and no deviation from them is allowed by law. However, the law declares that rates and services that are found to be unreasonable or injurious in any way to the shipping public are unlawful and must be changed. When shippers find a change necessary, they may seek relief by direct negotiation with the carrier involved, and, if it is not granted, they have the alternative of petitioning or filing formal complaint before the Interstate Commerce Commission.

Under the Motor Carrier Act of 1935, common and contract truck carriers are regulated in the same manner as are the railroads (including rates, insurance, safety, and operation). Except for safety, the Interstate Commerce Commission does not have jurisdiction over private trucks or over farm trucks owned and operated by farmers that are used in the transportation of their agricultural products or in the transportation of supplies to their farms. This exemption from jurisdiction applies also to motor vehicles controlled and operated by agricultural cooperative associations or federations of such cooperative

associations and to any trucker who hauls nothing but exempt agricultural products. Certain agricultural commodities including live poultry, dressed and ready-to-cook poultry, shell eggs (including shell treated), liquid eggs, frozen eggs, and dried eggs are exempt from rate regulations of the Motor Carrier Act. The legislative history⁷⁸ establishing the exemption of certain agricultural commodities is interesting, and it serves to put shippers on notice to keep abreast of developments in this field.⁷⁷

When shipping by rail or water, the rates, rules, and regulations contained in the Uniform Freight Classification and applicable rate tariffs must be observed. Corresponding regulations for the Railway Express Service are contained in the Official Express Classification in effect at the time of use. Those who ship by common motor carrier must observe any requirements given in the existing National Motor Freight Classification. Other individual motor carriers and the individual airlines have their own rules and regulations.

Receipts. When goods are delivered to a transportation company, a receipt must be furnished by that company. The railroads, truckers, and steamship lines furnish bills of lading, and the Railway Express Agency furnishes an express receipt.

Straight bill of lading. The railroads, steamship lines, and some truckers issue both negotiable and non-negotiable bills of lading. If a straight (non-negotiable) bill of lading is issued, the consignee does not need to have it in his possession in order to obtain delivery.

Order bill of lading. This form is negotiable. It provides for endorsements and may be used in the same way as a warehouse receipt, or any other evidence of property ownership, at banks or in transferring title. This method is a very popular form of billing for eggs and poultry, as it can be handled through the banks attached to a draft. The value of a carload of eggs or poultry amounts to several thousand dollars, and most shippers with several cars in transit do not choose to go on buying without a means of borrowing money on the eggs or poultry in transit.

On an order billing, the delivery of goods in the market cannot be made to the consignee until he surrenders the bill of lading. If this is held in the bank attached to the draft, he must pay the draft in full before receiving it for surrender to the railroad. If the original consignee obtains a purchaser for the goods before they arrive, he can sell the order bill of lading, which will carry ownership with it. The railroad will deliver the goods to anyone presenting the endorsed order bill of lading. An order bill of lading may be marked "inspection allowed," which obliges the railroad at the destination to permit in-

spection for determining the quality and grade of the goods even if the bill of lading is not surrendered.

Damage in transit. Public transportation companies are obliged by law to use all reasonable diligence and effort to handle and transport goods entrusted to them so that they may be delivered in as good condition as they were received, ordinary depreciation and deterioration excepted. Under the terms of the uniform bill of lading the carriers are not responsible for damage due to (1) act of God, (2) act of public enemy, (3) act of authority of law, (4) act of default of shipper, or (5) for natural shrinkage.

Handling claims. If a loss or damage claim against a carrier is to be made, to avoid any unnecessary delays, sufficient documents and evidence should be supplied in support, such as:

1. Original bill of lading or certified copy thereof.
2. Original paid freight bill.
3. Original or certified copy of invoice or other evidence of value.
4. Copy of Railroad Inspection Agency's joint damage report or notation of damage on paid freight bill from local freight agent.

If a claim is for damage in transit, it must usually be accompanied by evidence from the consignor, consignee, witnesses to the damage, and all possible proof of the amount of loss involved.

STORAGE OF EGGS AND POULTRY PRODUCTS

Perishable agricultural commodities such as eggs and poultry products held in cold storage warehouses from a period of surplus production to a period of scarce production, are usually held for a relatively long term. One year is set by law in most states as the maximum period for storage. Temporary or relatively short-term storage takes place on the farm and at almost every stage of marketing.

Location of the Industry

Warehouses may be defined as facilities having space artificially cooled to temperatures of 50° F or below, in which foodstuffs are held for 30 days or more. A recent survey⁸⁷ showed there were 2,673 refrigerated warehouses with a total of 901 million cubic feet of gross refrigerated space in the United States as of October 1, 1957. This is a 66 per cent increase over the 544 million cubic feet reported in the first survey made in 1921. Increases in the production of frozen foods

have had a profound effect upon the development and growth of the refrigerated warehouse industry.

The greater number of refrigerated warehouses are located in the Pacific Region (Table 23), and within this region Los Angeles and Seattle have the largest numbers of facilities. The East North Central Region is second largest, with Chicago the most important city. In the Middle Atlantic Region, the third in order of ranking, New York, Buffalo, and Philadelphia are the most important cities for storage facilities.

Refrigerated Warehouse Facilities

Refrigerated warehouses are of two general types. The older and more common type is the multistory building of square design. The second and newer type is the single-story building designed to take advantage of modern materials handling methods.¹

The economies gained by taking advantage of materials handling principles apparently have been significant because the cold storage warehouses built in recent years have been predominantly of the single-story type. As an example of one of the labor saving principles used, power fork lifts are used to unload motor trucks and to stack the pallet loads in the warehouse (Fig. 65).

Table 23. Refrigerated Storage Capacity by Regions, October 1, 1957

Gross space, in 1,000 cubic feet

Region	Number of Plants	Zero° F or below	Above Zero° F to 50° F	Total
New England	316	21,789	18,752	40,541
Middle Atlantic	574	75,914	89,363	165,277
East North Central	582	69,735	82,226	151,961
West North Central	149	58,673	46,568	105,241
South Atlantic	240	58,601	48,431	107,032
East South Central	62	13,424	8,463	21,887
West South Central	101	26,868	17,052	43,920
Mountain	56	9,600	4,945	14,545
Pacific	593	98,162	152,831	250,993
United States	2,673	432,766	468,631	901,397

Source: See reference 87 in the Bibliography.

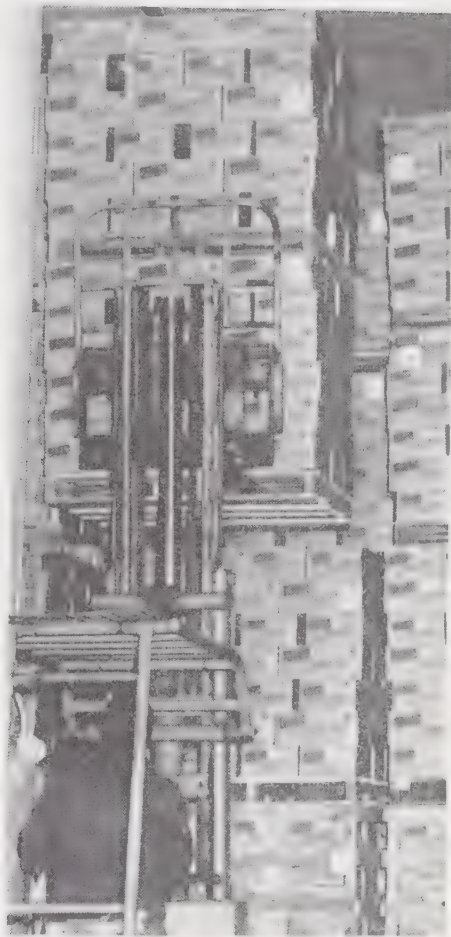


Fig. 65. Using a forklift truck for stacking pallet load in a freezer room. (U.S.D.A.)

Space in the refrigerated warehouses is of two general types: cooler space and freezer space. During and after World War II, to meet the growing demand for space to accommodate the rapid rise in frozen food production, new freezer space was constructed, and as need for cooler space became less, this space was converted to additional freezer space.

Importance of Storage Holdings

Using the peak holdings for 1955–1958 and comparing them with sales off farms shows that storage holdings of eggs (shell, frozen, and dried) were 4 per cent of sales off farms. Similarly, broilers were 1 per cent, fowl 13 per cent, and turkeys 22 per cent of sales off farms.

Eggs and poultry move into or out of cold storage warehouses almost every working day of the year. By using the data shown in Table 24, interesting trends are revealed in the storage holdings of eggs and poultry.

Table 24. Trends in Storage Holdings of Selected Egg and Poultry Items

(Holdings in millions of cases or pounds)

Item	1930-34	1935-39	1940-44	1945-49	1950-54	1955-58
<i>Shell eggs, cases</i>						
(a) Average	4.8	3.8	4.2	2.7	1.1	0.8
(b) Peak volume	9.1	7.5	8.4	5.6	2.5	1.6
(c) Peak month	Aug.	Aug.	July	July	July	July
(d) Low volume	0.2	0.2	0.3	0.3	0.1	0.2
(e) Low month	Mar.	Mar.	Feb.	Feb.	Jan.	Jan.
<i>Frozen eggs, lb</i>						
(a) Average	82.9	94.7	169.6	165.3	110.8	110.3
(b) Peak volume	111.8	135.7	276.1	238.3	178.2	172.2
(c) Peak month	Aug.	Aug.	Aug.	July	July	Aug.
(d) Low volume	51.3	50.7	62.4	91.2	42.5	57.6
(e) Low month	Mar.	Mar.	Mar.	Mar.	Feb.	Mar.
<i>Dried eggs (egg solids), lb</i>						
(a) Average	...	...	...	35.9	32.1	3.6
(b) Peak volume	...	...	...	39.6	37.8	5.3
(c) Peak month	...	...	...	Feb.	Jan.	Aug.
(d) Low volume	...	...	...	32.6	25.2	2.2
(e) Low month	...	...	...	Aug.	Dec.	Mar
<i>Broilers and fryers, lb</i>						
(a) Average	16.6	18.2	17.4	19.1	19.0	18.8
(b) Peak volume	27.6	31.2	28.4	27.9	24.0	25.3
(c) Peak month	Jan.	Jan.	Dec.	Jan.	Feb.	Jan.
(d) Low volume	7.2	8.3	7.0	10.9	14.5	14.9
(e) Low month	July	July	July	July	Aug.	Aug.
<i>Fowl, lb</i>						
(a) Average	10.0	14.3	30.9	48.6	47.4	45.0
(b) Peak volume	16.3	24.4	54.5	80.5	75.5	73.0
(c) Peak month	Jan.	Jan.	Dec.	Jan.	Jan.	Dec.
(d) Low volume	5.8	8.8	15.1	23.6	25.5	23.5
(e) Low month	June	June	June	July	Aug.	July
<i>Turkeys, lb</i>						
(a) Average	8.0	16.8	31.9	63.4	86.7	115.7
(b) Peak volume	14.0	28.2	55.3	97.2	131.5	209.3
(c) Peak month	Mar.	Feb.	Feb.	Feb.	Dec.	Nov.
(d) Low volume	1.9	5.0	12.9	30.3	40.7	62.6
(e) Low month	Nov.	Nov.	Oct.	Sept.	Sept.	Aug.
<i>Ducks, lb</i>						
(a) Average	...	4.7	5.1	5.2	8.7	6.7
(b) Peak volume	...	8.3	9.3	9.1	15.5	11.0
(c) Peak month	...	Oct.	Oct.	Oct.	Oct.	Oct.
(d) Low volume	...	1.1	1.1	1.9	2.5	2.7
(e) Low month	...	May	May	Apr.	Apr.	Apr.

Source: Computed from monthly issues of the *Cold Storage Report*, U.S.D.A.

The decline in the seasonality of egg production has been reflected also in the declining need for storing shell eggs. Both average and peak holdings of shell eggs have declined materially during the past 20 years. Also the peak month has shifted from August to July, and the low month from March to January. In the most recent years, the need for storing shell eggs has almost reached the vanishing point.

Frozen eggs show a reverse pattern. From the early thirties to the late forties, peak holdings doubled. Since then there has been some decline, but both peak and average holdings are definitely higher than 20 years earlier.

Dried egg storage holdings information is available only for recent years. The trends are largely influenced by government holdings.

Broilers and fryers have shown a fairly stable situation as far as storage holdings are concerned. Average holdings have risen slightly and peak holdings have declined. The growth in year-round production and marketing, and the trend toward fresh-dressed ice chilled ready-to-cook broilers and fryers have undoubtedly contributed to the lack of an increase in storage, although this industry has been showing tremendous growth since the mid-thirties. The peak months for storage holdings have been January or February, and the low months July or August.

Fowl storage holdings have increased by more than four times during the last 20 years. The marketing and slaughtering of fowl is highly seasonal, reaching a peak in the fall months. Thus, the peak in storage holdings occurring in December or January is to be expected. The low month is usually between June and August.

Turkey holdings have increased more than 10 times during the last 20 years. The peak month has shifted from March to November, and the low month has shifted from November to August. The growth of this industry and the highly seasonal slaughter in the fall months have contributed to these storage trends.

Duck holdings have increased substantially in the last 15 years, with the peak month occurring in October and the low month in April.

Warehouse Tariffs

Warehousing is a service function.⁴⁶ The warehouses serve operators engaged in production and distribution. As a return for services rendered, the warehouses assess fees which are commonly known to the trade as tariffs. These tariffs vary in accordance with the following factors: (1) Types of commodities stored; (2) kind of temperature furnished; (3) size of containers; (4) weight of commodity; (5) density of commodity; (6) length of the storage period; (7) type and

extent of additional services; and (8) cost of operating, including labor cost, real estate values, and type of equipment used. The first month's charge is usually higher than for subsequent months because the cost of handling the commodities into and out of the warehouse is included with the first month.

Cost of Storage

The costs of storing eggs and poultry products vary somewhat because of difference in warehouse tariffs and other factors. However, the following may serve to illustrate the average costs of storing shell eggs:

<i>Cents per dozen</i>	
First cost of eggs	30.00
Warehouse charges (8 months)	2.01
Insurance *	0.05
Interest (8 months at 5%)	1.00
	33.06

* Charges vary with the security of the warehouse.

In this example, the costs amounted to 10 per cent of the value of the eggs stored. However, the storing of eggs involves many additional expenses, such as accounting, handling of the eggs, and administrative expenses. There are also the risks that the eggs may deteriorate to an exceptional extent during storage and that future price declines may prevent the recovery of the original cost of the eggs stored plus storage costs.

Conditions for Storing Eggs and Poultry Products

Shell eggs. The rate of deterioration of shell eggs is largely dependent on the temperature at which they are held. The lower the temperature the longer the quality will be retained. Temperatures between 29° F and 31° F seem best. However, accurate temperature controls are necessary, since eggs freeze at 27.5° F.

At natural relative humidity in the storage room the eggs will lose considerable moisture and the air cells will become enlarged. To prevent this shrinkage the relative humidity of the storage room should be increased by artificial means, generally by spraying a water mist into the atmosphere in such amounts as to maintain the humidity within predetermined limits.

Although some rooms require more moisture than others, a relative humidity of 90 to 92 per cent should be satisfactory. The egg case

itself, especially if of wood, may absorb nearly a pound of water during the first 30 days of storage, and if the humidity of the air is not kept high, the case will act as a blotter and continue to take moisture from the eggs.

All storage rooms should have air circulation, but the products should not be stacked where a constant draft or flow of air will be directly against or over them. Sufficient air circulation is provided by carefully placed blower units, or sometimes, just by the opening and shutting of the doors in the elevator shaft when products are being taken in or out of the room.

Frozen eggs. Frozen eggs can be stored for long periods (up to several years) without decomposition at 0° F or lower, so far as quality deterioration is concerned. Most states however, as mentioned before, prohibit the storage of any form of eggs for more than 12 months.

Poultry. Investigations have shown that freezing poultry as quickly as possible and carrying it at a low uniform temperature produces a superior product. Uniform temperatures in storage warehouses of as low as -20° F are not uncommon. Temperatures for storing frozen poultry should be maintained at 0° F or lower.

In a room refrigerated by direct expansion or cold brine, moisture from the air freezes on the pipes. This moisture must come either from air entering through the doors or by evaporation from products stored. As the moisture freezes from the air, the humidity is reduced, so that moisture from the commodity is likely to be transferred constantly to the air to make up for its deficiency.

Evaporation of moisture from the product is increased by fluctuations in temperature. As the temperature rises, the relative humidity drops and evaporation increases, and as the temperature drops, the relative humidity rises and more moisture is frozen out of the air.

A saturated atmosphere in the frozen-poultry storage room is desirable. Where moisture is sprayed into the freezer rooms by means of power atomizers so that snow covers the packages, desiccation of the poultry is usually prevented. Motor-driven paint sprayers mounted on large milk cans containing water may be utilized for this purpose.

Evidences of poor handling, such as incomplete bleeding and rubbed skins, show up more prominently in frozen poultry than in fresh. Under severely fluctuating temperature and humidity conditions, the evaporation of the moisture from the skin of the carcass may be so great as to cause a collapse of the cells of the flesh. This collapse causes light-colored characteristic pock marks to appear upon the skin, known as freezer-burn. This is the outstanding visual defect in frozen poultry.

Questions

1. What major changes have taken place in the transportation of poultry products? What are some reasons for the change?
2. How has processing at country points concentrated poultry meat products?
3. What are the major transportation movements for eggs, broilers, and turkeys?
4. What are typical loads for tractor-trailer trucks of eggs and ready-to-cook poultry?
5. List the desirable temperatures to be maintained during transit for the following: shell eggs, frozen eggs, chilled poultry, and frozen poultry.
6. How is refrigeration supplied during the transportation of poultry products?
7. Define concentration-in-transit, partial unloading, diversion, and storage-in-transit.
8. How is an order bill of lading used?
9. Why has a declining need for the storing of shell eggs developed?
10. What has taken place in fowl and turkey storage holdings in recent years?
11. At what temperature and humidity are shell eggs stored?
12. At what temperature and how long can frozen poultry be stored?

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Merchandising and Retailing Eggs and Poultry

The marketing of eggs and poultry consists of the services required to take the products from point of production to point of consumption. It is comparatively easy to understand the general meaning of marketing as expressed in this sentence, but to know it in full detail we must also understand the intended meaning and use of the definition's key words and phrases. For this reason, "services," "point of production," and "point of consumption" are explained in detail.

Services

Services may consist of any function that changes the product as regards possession, time, place, or form. The producer who sells poultry and eggs directly to a next door neighbor performs relatively few marketing services in completing a producer-consumer market transaction, but, when production and consumption areas are many miles apart, various kinds of marketing services are required to handle the bulk of the product moving between these two groups. These marketing services, as they relate to the products, may be either of a physical or a nonphysical nature. Examples of some of the services that are commonly involved in market transactions of this nature include purchase, collection of product, transportation, processing, storage, refrigeration, advertising, market contacts, sale, delivery, and financing.

Point of Production

Point of production ends and market functions start when the product, in its natural state, receives physical service that is not performed as a purely production function but has a direct or indirect relation to marketing. In most cases, eggs approach this point at the time they are taken from the nest, for nearly all of the services they receive thereafter are intended to influence their market value. The movement of

poultry from production to market channels usually takes place at the time the birds are physically moved from the place where they are grown, to start their journey to the first receiver involved in the marketing of the product. However, either or both of the products described previously could have been involved in a prior market transaction consisting of the initial purchase of the product, which may precede or follow the first physical market functions.

Point of Consumption

Point of consumption is the place where the product is finally used or assimilated. The practical approach to this problem is one that considers a market transaction ended when the product is turned over to the final purchaser. Some services performed by the final purchaser are marketing functions that technically may be charged to marketing costs; but in most cases, they are relatively small and very difficult to measure. Thus, for practical purposes, marketing costs are generally considered at an end when the product is in the final purchaser's hands.

The marketing of eggs and poultry thus consists of a series of physical and nonphysical services. These services are normally handled by specialized marketing agencies, but they may be performed completely or in part by the producer, the consumer, or by a combination of all three interests. The purpose of the services is to move the products from their source of origin to the point of final consumption. The marketing of poultry products is increasing in volume, which tends to make the marketing problem a larger and more involved process.

EGGS AND POULTRY IN A LARGE AND EXPANDING MARKET

The American egg and poultry industry markets many billions of dollars worth of products each year. During the past century, its volume of production and value of product has steadily increased to a point at which it is now one of the nation's major agricultural industries. Its growth has resulted from its ability to supply consumers with desirable foods in convenience forms at places and prices that have met their current demands.

Both producer and distributor interests have contributed to this growth. Producers have improved their product through changes that have enabled them to meet the market's exacting demands. They have also improved their own production methods to a point where their present efficiency has greatly reduced product cost, which has especially benefited the consumer. Distributors have likewise con-

tributed to increased consumer demand by processing, packaging, and distributing the products in line with the current market needs. Both interests have made special efforts to please the consumer and to increase efficiencies so that poultry products could sell at prices that would enable them to compete successfully with other food items. The profit motive has been the principal factor in these changes that have contributed much to the volume increase in the poultry industry. The rewards for producers and distributors are pay for producing the product and for rendering the marketing services.

Basis of Pay for Producer

Those who produce the eggs and poultry that are sold through regular market channels normally receive payment based on some form of market price or quotation. The specific amount they receive for any given unit of product will be determined mainly by (1) the current market price, which in turn, is influenced by the available supply of similar or acceptable substitute products; (2) the quality of this specific product as related to the quality of like products in the same market area; (3) dependability of supply; (4) existing consumer demand.

Basis of Pay for Distributor's Services

The marketers, who are sometimes known as distributors or handlers, supply producers with the services required to properly move their products through the necessary market channels. They provide many marketing services. The marketers receive their payment in the form of commissions, or operating margins. Cooperative marketing agencies usually try to base their charges on actual operating costs.

Commissions are a predetermined percentage of the amount of the sale, which are paid to the commission merchant for performing certain marketing services in such a way that he does not take title to the product, but rather sells it to a customer for the person or firm shipping it to the market. The inflexibility of commission operations often makes them unsatisfactory, and most distributors are changing to the operating-margin basis of accounting. Operating margins are funds obtained by the handlers who plan to sell the product for enough to pay for the marketing services plus a reasonable profit.

It is often difficult for producers to fully understand the need and justification for adequate commissions or operating margins. From their point of view, production is usually considered to be far more important than distribution. On the other hand, those who handle the distribution problems and struggle with credit, inventory losses,

quality losses, customer service problems, and seemingly excessive costs in the fields of transportation, labor, and storage have a point of view that tends to place a greater emphasis on the importance of distribution. An impartial judgment would most likely give about equal value to the two phases of the problem, as the help of both are necessary to properly cope with the large and far-reaching distribution system required to move our total volume of eggs and poultry from producer to consumer.

PRODUCER-MARKETER EFFORT TO BUILD CONSUMER DEMAND

It is important to the general welfare of both producers and marketers to have a good, and preferably steadily increasing, consumer demand for eggs and poultry. Under these conditions, most of the products can be moved at prices that will more than cover their production and distribution costs. However, it is not an easy matter to create and maintain additional consumer demand for eggs and poultry, because these products are in constant competition with red meats, cereal grain products, and innumerable other food items. The interests behind these competitive foods are also working to promote the acceptance of their products by the consumers. In view of this steadily increasing competitive problem, the poultry industry is faced with the alternative of following the course of aggressively competing for a greater share of the consumer's dollar, or of doing little or nothing and allowing its competition to move ahead and thus reduce the relative importance of eggs and poultry. The more aggressive course includes, on the production side, more efficient production of better products and, in the field of distribution, it means more promotion and broader and more efficient distribution.

Because eggs and poultry have many nutritional and convenience advantages, they are in a comparatively favorable position in the field of competitive foods. Their relatively high consumer demand has been developed because, in the past, the egg and poultry industry has furnished products that have been acceptable to many consumers. The industry has also provided distributing facilities that have moved these products to the places, and in the condition desired by these consumers. There is, however, no assurance that the current demand will continue to hold indefinitely at the present volume and price structure rate. Future progress and the chance of increased volume will depend upon the effort made by all segments of the egg and

poultry industry to provide low cost, high quality eggs and poultry at the places and in the forms most wanted by consumers.

THE START OF MARKETING OPERATIONS FOR EGGS AND POULTRY

When egg and poultry products are ready for market, the producer most often uses the services of a marketing agency that specializes in the handling of the particular product that he is offering for sale. If the product is eggs, the producer will normally use a commercial or cooperative marketing agency that handles the eggs in the manner that fits the producer's conditions best. It may be an agency that provides a complete sizing, grading, and marketing service. Under these conditions, the producer's eggs may move from the point of production as an ungraded, uncandled product. The marketing cost for eggs of this nature may be higher than for eggs graded by the producer. However, by marketing ungraded eggs, the producer will have more time to devote to the task of increased production that may increase his total returns to the point of greater net profit. If eggs move from the source of production to the marketing agency in an ungraded form, the settlement price must make allowance to handle this marketing cost. When the marketing agency is one that will pay a higher return for eggs that are graded for size or candled to meet a specific grade, the producer may prefer to provide these services before the eggs leave the farm.

In some instances the distributor is willing to pay the producer on the actual qualities found in the eggs but wishes to do the grading himself to be certain that the resulting pack is up to a very definite standard he has set for his product. In virtually all cases, eggs must be graded, and the grading cost must be added to the value of the eggs. If part, or all of the grading service is done at or near the point of production, the proportional cost of this service can be added to the initial cost of the eggs.

The day-to-day costs of performing egg and poultry marketing services tend to remain quite constant. During the past decade they have generally increased in line with other operating costs. However, both the marketer and the producer are constantly facing variations in product value due to the changes in market price. The price changes that take place between the distributor's purchase and sale period produce inventory gains or losses.¹⁴

RETAILING EGGS AND POULTRY

The retailer is the final link in the chain of distribution between the producer and the consumer. It is his function to provide an adequate supply of all foods, including all needed sizes and grades of eggs and poultry. As competition between retailers of all classes is keen, attractive displays, courteous service, high quality, and reasonable prices are necessary to attract and hold the consumers' trade.

Most stores handle two or more sizes and grades of eggs and the various kinds of poultry which are generally sold in the locality. The buying power and habits of the community determine to a certain extent the variety of merchandise carried by the successful retail store.

Acceptable quality is a very important factor in retailing poultry and eggs. An off-flavored product creates dissatisfaction, resulting in decreased business. On the other hand, fine flavor and a clean, attractively packaged product leads to repeat sales and enhances the reputation of the seller. Unfortunately, customers seldom complain; they simply remain away if quality and service are unsatisfactory.

Classes of Retailers

Most eggs and poultry move to the consumer through chain stores, or through independent merchants who operate either small stores or supermarkets. There are also many other retail outlets, such as cut-up chicken stores, operated in single locations or as independent units which are a part of a larger retail agency, roadside stands, itinerant peddlers, and producers who sell direct to consumers. Producers selling direct to consumers are discussed on pages 269-273.

The operation of the independent merchant is well known. The eggs and poultry that he sells are generally purchased from various wholesalers or, if he is located in certain areas, he may purchase directly from producers or local processors. The rapid increase in the size of commercial flocks is leading to more of the direct producer-to-retailer transactions in some areas.

Chain stores. A chain of retail stores may consist of a few or of several thousand stores managed by one organization. The individual stores of the chain are developed in accordance with the needs of the community in which they are located. Some are entirely cash-and-carry; others make deliveries and allow credit.

The low margins of profit generally taken by the chains lead them, during both advances and declines, to adjust retail prices to wholesale

prices more closely than the independents did prior to chain store activities. This low margin has discouraged some small, single-store owners; but others state that, by keeping their stocks fresh, avoiding unpopular items, catering to the personal needs of their customers, and giving close attention to their buying, credits, displays, and the like, their business has been helped rather than harmed by the chain stores.

The changes that the chains have introduced into the business of distributing eggs and poultry have progressively improved the average quality of poultry products sold and lowered the cost of distribution. These improvements have given the consumers a lower-cost product, increased consumption, and provided the producers with a higher percentage of the consumer's dollar.

Independent retail grocers. The independent retailers have worked out cooperative purchasing and advertising arrangements that have enabled many of them to remain competitive in the retailing field. In view of the perishability of both poultry and eggs, and owing to the fact that these products are produced in commercial quantities in all states, many independent retailers handle large quantities of locally-produced eggs and poultry. Many business transactions for these products are made directly between the independent retail grocer and the nearby producer or the local egg and poultry processing plant.

Cut-up poultry stores. In thickly populated districts, such as apartment-house sections of our larger cities, there are stores that specialize in the sale of separate parts of chicken and, sometimes, turkey. These stores also handle tray-packed broilers and dressed whole birds, but the bulk of their sales consists of parts. Poultry parts are also sold in many regular meat markets or meat counters of grocery stores.

Sales of poultry parts offer some special advantages to consumers. If a family is small, and all members prefer dark meat, they buy drumsticks and second joints. On the other hand, mixed preferences result in the purchase of two pieces of breast meat and two drumsticks. Company luncheons and dinners may call for one breast of chicken or a turkey steak for each guest.

These stores may also sell fowl cut up for fricassee and drawn poultry of all kinds. However, the main business is generally in cut-up frying chickens, the separated parts of which are displayed on beds of crushed ice (Fig. 66). The parts are perishable and discolor easily, and so only enough birds should be cut up for each day's sale.

The parts are generally priced in accordance with consumer preferences and their proportionate part of the cost of the whole bird. Variations in prices between wings, breasts, legs, necks, and other parts



Fig. 66. Two views of refrigerated show case for poultry in a modern supermarket. (Courtesy American Stores Co., Philadelphia, Pa.)

help to keep all portions of the birds moving at about the same proportionate speed. Usually, the highest prices are obtained for livers, breasts, legs, and second joints, which may sell for approximately twice the price of the whole bird. Hearts and gizzards are usually

a little below the whole-bird price. Backs, necks, and sometimes the wing tips are about half the price of the whole bird. Feet, if saleable at all for soups or gelatin, usually bring about half the price of backs and necks.

Roadside stands. Roadside stands provide outlets for eggs and poultry in areas where conditions are conducive to this type of sale. In recent years, the super-highways leading to and from many of the larger cities have been constructed and restricted in such a way that they discourage roadside sales. This practice is in the interest of safety and to prevent traffic congestion. In the more rural areas, and in places where the roadside stands are a safe distance from the highway, this type of selling provides a good outlet for large quantities of locally-produced eggs and poultry.

The basic concept of roadside stand selling is that these stands represent the product of one farm, or possibly a few farms in the vicinity. The stocks of these stands, if secured from the immediate neighborhood, are necessarily seasonal. The theoretical economic justification for roadside stand operations is based on the fact that consumers are assured of freshness of product at a price that should fall between the wholesale and retail market. This method of operating brings the producer more money than he would get by selling wholesale, and it still provides the product to the consumer at a figure somewhat lower than the retail market. Elimination of transportation and other wholesale costs are considered to be the source of savings that make this type of transaction possible.

In actual operation, the theoretical concept does not always run true to form. Unfortunately, the bona fide producers who operate roadside stands often find that they are competing with a group of roadside retailers who are nonproducers and who purchase all or most of their eggs and other products from regular wholesale outlets. They establish roadside markets in the rural areas adjacent to large cities and offer produce that is no better and sometimes not as good as can be purchased in the city retail markets. Another factor working against the roadside stand is that modern methods of handling farm products preserve freshness, and large unit operations reduce cost. These methods make it possible for consumers in large cities to procure poultry products in a state of freshness and at prices that now make the roadside stand offerings less attractive.

Itinerant peddlers. In former years, and especially in periods of unemployment, some men became engaged in the peddling of poultry and eggs from house to house. The products they handled were sometimes purchased direct from producers, but many were purchased in

the wholesale markets where products of varying quality are available. This method of selling eggs and poultry is tending to decrease because of (1) increased consumer confidence in regular retail store product; (2) the comparatively high cost and low labor return for house to house selling; (3) increasing numbers of housewives working, which results in fewer people being home during the hours when the peddler is likely to call.

Retail Handling of Eggs

Proper retailing of eggs in food markets involves both consumer appeal and quality protection for the product. Accomplishing these two objectives has increased their share of the retail egg business for many food stores.

Bulk or mass displays of eggs that attract the attention of consumers in self-service markets, are an excellent method of increasing sales. However, improper mass displays that subject the eggs to extended periods of excessive heat and substantial quality loss can change the temporary advantage of larger sales into an eventual loss of volume through a decrease in consumer satisfaction.

Alert retailers reduce loss of egg quality and value by being certain that the oldest eggs in their stock are not covered by new arrivals so that their sale is delayed. To avoid this situation with cartoned eggs, many retailers, especially the larger chain stores, mark each carton with a date or code so that the length of time it has been in that store may be readily determined. The candler's number also may be marked on the carton to make candlers more careful and to place the responsibility if a customer complains. The trend is for retailers to keep both display and reserve stocks of eggs under refrigeration at all seasons of the year. Of course, eggs must not be placed in a compartment with odorous foods.

To make more effective displays and allow customers in self-service stores to serve themselves readily, open-top, artificially refrigerated display cases are rapidly replacing open shelves and wall refrigerators for dispensing eggs. Special display cases designed for the sale of eggs only are now available for retail markets. These cases, in addition to providing for ample refrigerated display and reserve stock space, often carry attractively colored pictures that give eggs special appetite appeal and encourage impulse buying (Fig. 67).

A few retailers continue to buy uncandled or loosely candled eggs and then recandle them in the store before sale. Although this may be necessary in some instances, as in small towns where eggs are bought directly from producers or where it is necessary in order to make certain of meeting technical state or municipal regulations, the



Fig. 67. Cornell egg display case. Refrigeration is maintained through the back, ends, bottom, and partitions. (Courtesy Cornell University, Ithaca, N. Y.)

practice usually means a loss in efficiency. Wholesalers or jobbers, and in some cases producers, are in a position to candle more accurately and, having a wide variety of customers, can dispose of undergrades more satisfactorily.

It is now general practice to deliver eggs to the consumer in cartons (Fig. 68). In past years, the cartoning of eggs has been confined largely to placing them in single-dozen cartons in the candling rooms of the wholesalers, jobbers, or chain stores. In virtually all cases, these candling rooms were located within a range of 50 miles or less from the retail stores serviced. The trend of recent years has been to perform the grading and cartoning service nearer to the point of production. Large quantities of eggs are now being cartoned and shipped for sale at retail at distances well in excess of 1,000 miles.

Marketing programs and variations in egg production and size. Although the retailer is not directly charged with the responsibility of solving the producer's irregular supply problems resulting from normal, seasonal variations in size and quantity of eggs, a knowledge of these problems will help the retailer in planning a more realistic egg-marketing program.

The production of an exceptionally good flock of well-managed layers will average around 70 per cent production during their first full year of lay. However, this does not mean that for every hundred birds a producer has he will be able to send a daily average of 70 top-

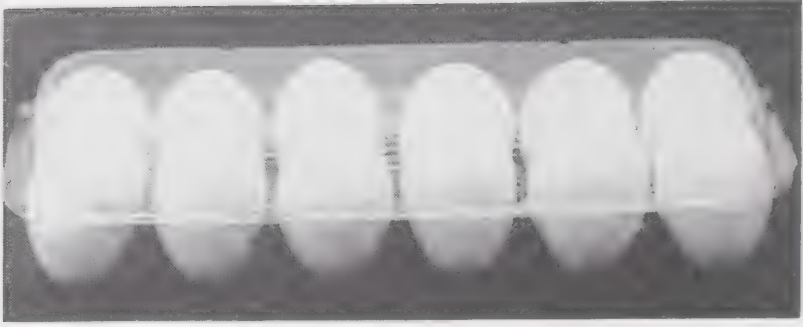


Fig. 68. A completely transparent egg carton designed at Cornell University. Consumers like to see the food products they buy. Transparent cartons of this general type are now on the market commercially. (Courtesy Cornell University, Ithaca, N. Y.)

quality eggs to market. Eggs from any flock at any time will vary in size. In large eggs, the peak daily production period per hundred layers is likely to be approximately 56 eggs, and the year's average around 44 per day. The daily production of mediums will probably vary from about 47 to 13 eggs, and smalls from about 21 to as low as 1 egg per day.

Variation of egg size is closely associated with period of lay. The smaller sizes will dominate at the start of the laying period, with the percentages of pullets or small reaching a peak percentage of a little over 57 per cent during the first full week of lay. After the first week, the percentage of mediums should rise quite rapidly to over 62 per cent. By the end of the first third of the laying year, the percentage of large eggs should be well above 50 per cent and the pullets or smalls below 5 per cent. In addition to this, the flock may at all times be expected to produce approximately 6 per cent seconds, or commercial grades consisting of checks, cracks, broken, odd shapes, rough shells, thin shells and occasionally, a badly off-colored egg. There may be 1 to 2½ per cent of eggs with blood spots that must be removed, since they are of little or no value.

A common error of both producers and marketers is to calculate the market potential of a flock on the basis of production totals rather than on the number of marketable eggs. For example, a large egg with a blood spot will count on production records but will be of little or no value after receiving a market grade.

Retailing of Poultry

Poultry marketing has undergone considerable change since the close of World War II. Prior to, and immediately following the war,

many poultry marketing interests believed that the postwar trend in poultry marketing would lead to the bulk of the product being hard-frozen and prepared in ready-to-cook, or eviscerated form. Except for turkeys, the trend to the frozen phase of the product did not develop as expected.

Broilers and fryers, which are the industry's largest volume poultry meat item, increased the output of ready-to-cook fresh-chilled or ice-packed birds and rapidly decreased the percentage on the hard-frozen side. Fresh-chilled broilers have since continued to increase in volume owing to their fresh flavor, consumer preference for the non-frozen product, and satisfactory shipment to any part of the country, if they are packed in ice.

The ice-packed method, which was originally developed for birds that were noneviscerated or, as the trade called them, "New York dressed," was found to work equally well with full-drawn or eviscerated broilers, and thus was adopted for them. Ice packing has the advantage of eliminating the cost of freezing, and it permits rapid handling in the processing plant. Eviscerated birds can be chilled in ice, or slush ice water, and immediately packed in cracked or flake ice in crates that normally contain 20 to 30 head. They can then be started immediately on their way to nearby or distant markets. During transit, the ice chilling process continues, and the bird may gain a slight amount of weight by absorption of moisture. The amount of absorption is enough to give the birds a fresh-killed appearance upon arrival at the retail market.

The most common method of packaging broilers and fryers to be sold at the retail level is cut up and attractively arranged in the proper size tray packs. A tray pack is usually a rectangular pressboard or molded pulp container in which birds are placed and covered with a transparent wrapper. Sometimes the container is made of plastic, and in some trays a pad is placed on the bottom to absorb excess moisture. A transparent wrapper, usually printed in harmonizing colors, often containing a brand label and sometimes a quality or sales appeal statement, is wrapped around both product and package and is hermetically sealed on the under side. Whole birds and halves are often tray-packed in much the same way.

Although tray-packing was originally a retail-store operation, some processors are now doing it at their country plants. The resulting economies should encourage a rapid expansion of tray-packing at the processing plants if the processors can make certain that satisfactory quality and service is assured.

Present methods of processing broilers produce an eviscerated whole bird that yields the processor approximately 75 per cent saleable

product. When the birds are cut up for tray-packing, whether it be at the processing plant or in the retail store, there is an additional loss of approximately 2 per cent in weight, which in addition to the labor and overhead cost of cutting up and tray-packing, increases the price at which the product must be sold.

Consumer preferences for poultry meat. The hope of the poultry people is that poultry consumption may be greatly increased, thereby, giving the poultry industry a much larger share of the total meat consumption. In reality, this is precisely what has been happening during the past twenty years. The record has not been equally encouraging for eggs, particularly since 1952 (Table 25).

In 1940, the nation's per capita consumption of all meats was 159.0

Table 25. The Per Capita Consumption of Eggs and Poultry Compared to Red Meats, Selected Years to 1940 and Annually 1940-1958 *

Year	Eggs Number	Ready-to- Cook Chicken, † lb	Ready-to- Cook Turkey, lb	Total Ready-to- Cook Chicken and Tur- key, lb	Total Red Meat, lb	Total Red Meat and Chicken and Turkey, lb	Per Cent That Ready- to-Cook Chicken and Turkey is of all Meats
1930	331	15.7	1.5	17.2	129	146.2	11.8
1935	280	13.1	1.7	14.8	117	121.8	12.2
1940	319	14.1	2.9	17.0	142	159.0	10.7
1941	311	15.4	2.9	18.3	144	162.3	11.3
1942	318	17.7	3.0	20.7	140	160.7	12.9
1943	347	23.0	2.7	25.7	147	172.7	14.9
1944	354	20.4	2.7	23.1	154	177.1	13.0
1945	402	21.6	3.5	25.1	145	170.1	14.8
1946	379	19.4	3.7	23.1	154	177.1	13.0
1947	383	18.1	3.6	21.7	155	176.7	12.3
1948	389	18.3	3.1	21.4	145	166.4	12.9
1949	383	19.6	3.3	22.9	145	167.9	13.6
1950	389	20.6	4.1	24.7	145	169.7	14.6
1951	392	21.7	4.4	26.1	138	164.1	15.9
1952	390	22.1	4.7	26.8	146	172.8	15.5
1953	379	21.9	4.8	26.7	155	181.7	14.7
1954	376	22.8	5.3	28.1	155	183.1	15.3
1955	371	21.4	5.0	26.4	163	189.4	13.9
1956	368	24.6	5.2	29.8	167	196.8	15.1
1957	358	25.6	5.9	31.5	159	190.5	16.5
1958	348 ‡	28.5	5.6	34.1	152	186.1	18.3

* Civilian consumption only, beginning 1941.

† Includes broilers and farm chicken. This figure also includes ready-to-cook duck and geese after 1940; quantities were too small to change the total.

‡ Estimated.

pounds. At that time, only 17 pounds or 10.7 per cent consisted of poultry products. The percentage of per capita consumption of poultry meats as compared with red meats and the total poundage of poultry products have both shown steady increases. Between 1940 and 1958 total poultry consumption nearly doubled. Consumption of farm chicken declined during this period, but this loss has been offset by the increase in broilers and turkey (Table 25).

In Figs. 69 and 70, we observe an interesting and encouraging story of progress for the present-day poultry-meat industry. These records show that between 1909 (the year of the first official record) and 1941, per capita consumption of all poultry meats in pounds per person and the percentage of poultry meat as a part of the nation's total meat consumption showed virtually no increase, and only slight variation. The consumption of poultry meat during that 32-year period was between 15 and 18 pounds per person, which represented an approximate range of 10 to 12 per cent of total meat consumption.

The poultry industry reached its all-time low in both per cent and per capita consumption in the 1934-1935 period. It was during this period that broiler growers were just starting large-scale commercial production, which thereafter resulted in a slow, but gradual upward

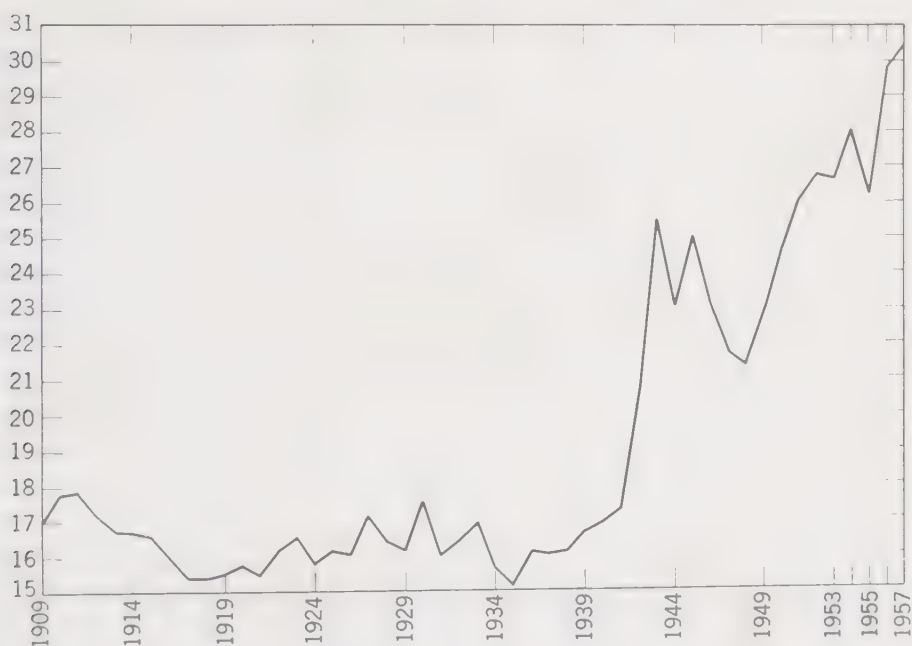


Fig. 69. The per capita consumption of poultry meats (including chicken, turkey, duck, and geese) in pounds between 1909 and 1957. (Based on U.S.D.A. data.)

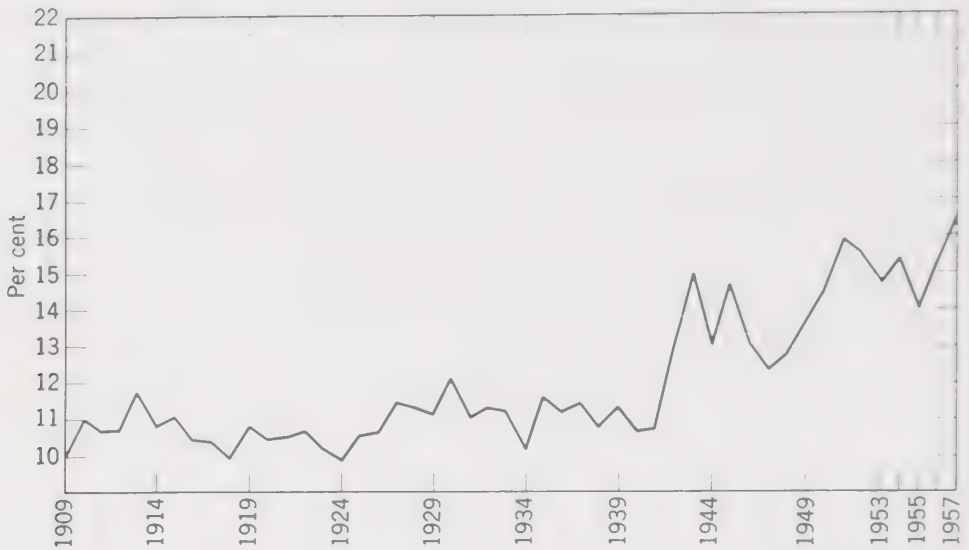


Fig. 70. The per cent of per capita consumption that all poultry meats (including chicken, turkey, duck, and geese in ready-to-cook form) are of the total per capita consumption figure for all meats, except fish, from 1909 through 1957. (Based on U.S.D.A. data.)

trend in volume. When war conditions increased the demand for meats of all kinds, the turkey and commercial broiler industry responded very rapidly. Between 1941 and 1943, the civilian population increased its use of poultry meats by an average of 8 pounds per person. The Armed Forces also used more eggs and poultry during that period and during the remaining years of the war. Production and consumption of broilers and of broiler and turkey meat dropped sharply when the war ended, but turned upward the following year, and with but few minor exceptions has continued to show a steady growth. From a poultry industry point of view, it is of special interest to note that this increase applies to per capita consumption as well as per cent of poultry meat per capita compared with red meats.

MARKETING MARGINS AND COSTS

There is a keen interest on the part of many people in marketing costs, marketing margins, and the share of the consumer's dollar received by farmers for food. For most statistical studies of this subject the farm-retail spread or marketing margin is calculated as the difference between the retail price of a product and its farm value, the

payment (adjusted for by-product values) to farmers for an equivalent quantity of farm products.

The farmer's share of the dollar spent by consumers for food is the percentage which the computed farm value bears to the retail price. This can be expressed in cents or as a percentage. The more highly processed the product is, in general, the smaller is the farmer's share (Table 26). Foods derived from animals and animal products tend to have a higher farmer's share than those derived directly from crops. The average distance shipped in getting products from the farm to the consumer and the perishability of the products affect the marketing margins and, consequently, the farmers' shares.

Eggs

The farmer may receive only 25 cents for a dozen eggs and only three of that dozen may reach the ultimate consumer as top grade at 60 cents per dozen; another three may sell as second grade at 40 cents; five more as checks or low grade at 20 cents. One egg may have been worthless at some step in the marketing operation, perhaps because of being candled out as a blood clot or some other type of loss or being broken in the course of handling. In this instance the selling price for the whole dozen is about 40 cents, and the 15-cent margin above the farmer's net returns is the charge for distribution, amounting to about

Table 26. Variations in Farmers' Share in the Consumer's Dollar by Type of Food Product, Average 1952-1956 ⁹²

Type of Product	Farmers' Share, per cent	
	Range	Average
Eggs		69
Frying chickens		60
Unprocessed crops such as dried beans, fruits, and veg- etables	18 to 46	35
Processed dairy products such as butter, milk, ice cream	19 to 71	49
Processed crops, such as flour, cereals, canned fruit and vegetables, fruit juices	16 to 40	26

one-third of the average retail price. One sometimes hears statements to the effect that eggs are bringing only 25 cents in the country and selling for 60 cents in the city. Such statements as the example just cited arouse an unwarranted feeling of injustice in the minds of producers and consumers, who do not stop to think that it costs more to distribute eggs in such a way as to retain their fine quality than it does to handle them carelessly. In the foregoing example it would have been to the producer's advantage, of course, if the entire dozen were of the 60-cent grade. He would have received much more for them in competitive bidding when distributors discovered that, owing to their fine quality, more than the normal profit could be realized in handling his eggs.

Additional marketing cost, other conditions remaining equal, must serve to provide greater consumer satisfaction or the additional cost will not be absorbed. For instance, packing eggs in cartons at a cost of 3 cents per dozen attracts additional purchases from some consumers who appreciate the neater appearance of the package and the added convenience in handling. Cartons also save time, breakage, and mistakes on the part of the store salesman. The gains from this additional cost probably amount to more than 3 cents, and so the practice remains and grows. In like manner, justifications are discovered for new and unique services all along the line, such as more frequent deliveries, novel advertising, closer grading, or better displays. Likewise, customers are attracted by lower prices resulting from such economies as self-service, cash and carry, plain packages or medium-size eggs of fine quality at a substantial discount under the price of large eggs. To satisfy all kinds of producers and all kinds of consumers, all kinds of services at all kinds of prices must be supplied, and it takes all kinds of middlemen to do it.

Free competition among distributors usually keeps costs for any established marketing route down to the practical minimum; when competition fails to keep a balance it is not long before public sentiment steps in by means of substitutions or boycott.

As concluded from one study,⁹² the absence of any upward trend since 1952 in the farm-retail spread in spite of increased costs apparently indicates improvement in efficiency and possibly a tighter competitive situation (Fig. 71). Costs may have been reduced through integration and bypassing certain types of handlers in marketing a growing proportion of the production.

Specialization in the production of eggs and increased volumes handled have made large-scale plants, extensively equipped with mechanical egg-handling equipment, economically feasible. The decrease in seasonal variation in the production of eggs has reduced stor-

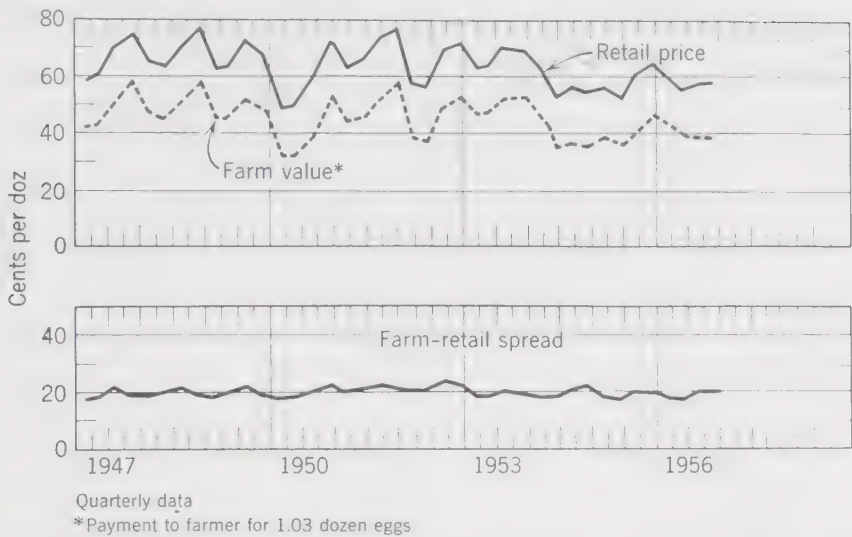


Fig. 71. Retail price, farm value, and spread for eggs. (Adapted from U.S.D.A., AMS.)

age costs. The proportion of the total egg production that is near large cities has increased, thus shortening shipping distances.

In 1956, the Agriculture Marketing Service of the U.S.D.A.⁹² collected information regarding eggs shipped by Midwestern assemblers and sold to consumers by retail stores in a large distant city. Consumers paid about 56 cents per dozen for the large Grade A eggs. It was found that the retail price was shared by farmers and marketing agencies as follows:

	<i>Cents per Dozen</i>
Retail-store gross margin	10.0
City distributor's gross margin	3.3
Country assembly plant gross margin	8.2
Price received by farmers	34.5
Total (retail price)	56.0

In these studies the price received by the country plant was for eggs delivered to the city in which the retail store was located. Transportation costs from the plant to the city market were about 1 cent per dozen and were a part of the plant's gross margin, which also included costs of procurement, candling, and cartoning.¹³

A survey conducted earlier provided information concerning the gross margins of assemblers and wholesalers.¹⁵ According to this survey the typical gross margin of Midwestern assemblers who shipped

uncartoned eggs to Eastern markets in 1954 averaged about 9.5 cents per dozen and was composed of the following items:

	<i>Cents per Dozen</i>
Freight to Eastern markets	2.7
Labor	0.7
Cases, fillers, and other supplies	2.0
Payments to buyers and independent dealers	2.4
Trucking from buying stations	0.6
Overhead, miscellaneous costs, and profit	1.1
Total	9.5

The payments made to buyers at buying stations and independent dealers were for collecting eggs from farms, grading, and handling.

The typical gross margin for wholesalers in an Eastern city who candled and cartoned eggs has been estimated at 6.8 cents, made up of the following items:

	<i>Cents per Dozen</i>
Labor	2.5
Cartons	2.2
Inspection	0.2
Miscellaneous costs	0.6
Overhead and profit	1.3
Total	6.8

Poultry

What has been said about costs of marketing eggs applies generally to dressed poultry and live poultry. In all instances waste means low returns to the producer and high cost to the consumer, far beyond the ability of any cut in distribution costs to correct. Efficient low-cost production, plus low marketing margins, make it possible for poultry to be offered to the consumer at prices that give the product an advantage over red meats and other competitive foods. The combination of low production costs and low marketing margins have contributed largely to the very rapid growth of the broiler industry during the past decade.

Poultry is a product that has been quite commonly used as a loss-leader or traffic getter, which means that the retailer sometimes sells poultry to the consumer at a price that is approximately the same or, in some cases slightly below actual cost (Table 27). The purpose is to get customers into the store with the hope that their purchases

Table 27. Broiler-Fryer Costs * from Producer to Consumer; Approximate Average Chain-retailer Operation (When Retailer Takes Normal Retail Markup)

	<i>Cents per Pound</i>
Price per pound paid to producer (The figure 20¢ is an arbitrary one selected for purpose of example)	20.00
Dressing loss, approximately 25% (Increases cost of saleable meat)	6.67
Total cost, saleable meat	26.67
Cost per pound for dressing	6.75
Processor's actual cost	33.42
Processor's profit margin	.95
Processor's selling price	34.37 †
Retailer's marketing cost and normal profit	8.50
Normal price to consumer	42.87

* All costs except price paid producer are based on eviscerated weight.

† This is sometimes the price to consumer, when retailer uses the product as a loss-leader.

Source: Data adapted from reference 12 in Bibliography.

of other items will more than offset the loss on poultry sales. When stores use poultry as loss-leaders, it is hard to explain economic relationships.

Frying chickens. According to the U.S.D.A. study,⁹² the monthly average prices producers have received for frying chickens (often called fryers or broilers) have varied as much as 5 to 10 cents per pound during each calendar year since 1949. The largest year-to-year change in the annual average farm value was 7.6 cents per pound between 1955 and 1956 (Fig. 72). (The farm value is the farm price per pound multiplied by 1.37, which is equivalent to a ready-to-cook yield at 73 per cent of live weight.) Prices farmers received for frying chickens declined in the fourth quarter of each year. During the past 10 years farm prices and retail prices for frying chickens have declined substantially, making this product a "best buy" on many occasions. During this period the marketing margin has remained relatively stable or has declined slightly.

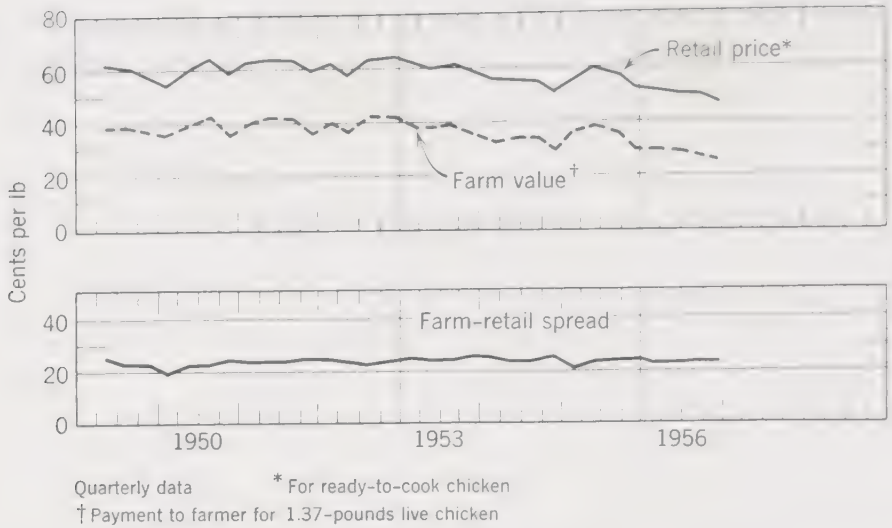


Fig. 72. Retail price, farm value, and spread for frying chickens. (Adapted from U.S.D.A., AMS.)

Like firms marketing eggs, poultry-marketing firms apparently have been able to keep costs down, although prices, wages, and transportation charges have risen. Processors have built large, well-equipped plants in the producing areas. Lower costs of assembling live birds at country plants instead of distant city plants, have more than offset the higher costs of shipping ready-to-cook birds to distant markets.

Information has been obtained on prices, spreads, and marketing costs for ready-to-cook frying chickens retailed in Chicago during July and October 1955.¹⁴ The average spread between the retail price in a sample of independent stores and the price paid wholesalers was 10.3 cents per pound in July, when the retail price averaged 55.1 cents per pound, and 8.8 cents per pound in October, when the retail price was 47.1 cents. In a sample of chain stores the retail price in July 1955 was 56.8 cents per pound, and the spread was 9.6 cents between this price and the average price these stores paid for fryers delivered, free on board (F.O.B.) Chicago. In October the retail price was 49.8 cents per pound, and the spread was 10.0 cents.

Data were obtained from wholesalers who bought fryers from processors in trucklots, F.O.B. Chicago, and sold them in smaller quantities to retail stores, restaurants, hotels, and other buyers. Their price spread averaged 2 to 3 cents per pound in July and October 1955. Labor constituted about 70 per cent of a typical wholesaler's total operating costs; plant costs including fuel, power, and light accounted for 11 per cent of the total; transportation, 9.5 per cent; selling, 4.5 per cent; overhead, 4.0 per cent; and miscellaneous costs, 1.0 per cent.

Farmers in Arkansas and Georgia produce a large part of the frying chickens marketed in Chicago. These chickens are processed in large plants in the states where they are produced. Processors there had an average gross margin in July and October 1955 of about 7.5 cents per pound, ready-to-cook basis.¹⁴ Their approximate costs per pound were:

	<i>Cents per Pound</i> (Ready-to-cook basis)
Assembly of chickens from farms	0.75
Feeding birds at plant *	.25
Processing and packaging labor	3.00
Boxes and other packaging material	1.00
Freight to markets	1.25
Overhead, miscellaneous costs, and profit	1.25
	—
Total	7.50

* Occasional short holding

Turkeys. A recent study of farm-to-retail marketing margins for turkeys showed wide variations for the different seasons of the year, various marketing channels and cities, and for turkeys of different types and sizes.

During the Thanksgiving week of 1954 the average farm-to-retail margin on ready-to-cook turkeys sold by retail stores in Washington, D. C. ranged from 10.6 to 18.9 cents per pound sold at retail. A year later a similar study for turkeys sold by retail stores in Boston showed the margin ranged from 15.3 to 22.7 cents per pound, and turkeys sold by retail stores in Cincinnati showed a margin that ranged from 12.0 to 20.3 cents per pound.

Operating costs of plants slaughtering and preparing ready-to-cook turkeys showed a fairly narrow range. Five plants gave the following detailed breakdowns of their costs:

	Range, cents per pound	Operating costs—1955 (Ready-to-cook basis) Average, cents per pound
Trucking	0.15 to 0.57	0.36
Plant labor	1.43 to 3.25	2.34
Office management and other office	0.17 to 0.95	0.56
Packaging	1.47 to 1.70	1.58
Miscellaneous and overhead	1.35 to 2.73	2.04
	—	—
Totals	4.57 to 9.20	6.88

Storage costs averaged 72 cents per hundred pounds for the first month and averaged 24 cents each month thereafter. Transportation costs for trucklots and rail carlots of ready-to-cook turkeys varied from 1 to 4 cents per pound. Average gross margins of 2.2 cents per pound were reported by wholesalers in Washington on frozen ready-to-cook turkeys sold in small lots to retail stores, restaurants, and hotels during the Thanksgiving and Christmas weeks in 1954.

Gross margins of retailers showed considerable variation. In metropolitan Washington, for example, average gross margins of chain stores selling ready-to-cook turkeys during November and December 1954 ranged from 0.0 to 3.8 cents per pound. During the other 10 months the gross margins of chain stores ranged from 3 to 8 cents per pound. Independent retailers' gross margins during Thanksgiving and Christmas weeks ranged from 3 to 10 cents per pound for frozen ready-to-cook turkeys and 2 to 10 cents per pound for ice-packed, ready-to-cook turkeys.

Questions

1. What are some of the physical and nonphysical services rendered in the marketing of poultry products?
2. How is the basis of pay for the producer determined when he markets his products through regular market channels?
3. What are some of the problems that make it very necessary for adequate commissions or operating margins for distributors?
4. What is the marketing margin for chicken?
5. What are some of the present-day costs involved in poultry processing and marketing operations?
6. Give examples of chicken and turkey being used as "loss-leaders" or "traffic getters"? Use current prices to prove your point.
7. On a ready-to-cook basis, how does the per capita consumption of poultry products compare with that of other meats?

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Prices and Market Information

At each level of marketing at which ownership of eggs and poultry changes hands, a price must be agreed upon. To sell now or wait and sell later when the price may be higher is a decision which is influenced by anticipated changes in prices. Market information on present and future supplies, current prices, and present or future changes in demand help sellers and buyers reach decisions.

PRICES

The two largest categories of prices in egg and poultry marketing are current prices and future prices.

Current Prices

Current market prices are the day-to-day prices agreed upon by buyers and sellers as eggs and poultry move through the market channels. Some prices are determined on individual lots by bargaining, haggling, or negotiation. Some prices are determined by sales at auctions or on mercantile exchanges. More frequently, however, the buyer and seller may have an agreement or understanding that the price for current shipments will be based on current market prices on the day of arrival at the market, or on a certain premium or discount to be deducted from the published quotation for a particular grade on that day. This set-up is known as the base price quotation system.²⁵ These agreements remain in effect as long as both buyer and seller are satisfied, sometimes for many years.

Since the method of determining price is established by agreements for a large portion of the eggs and poultry moving through marketing channels, it is only the portion of the movement that is not so committed, on which a price must be based. This is accomplished at both ends of the marketing system. For example, on the demand side, the North Atlantic Region is the largest deficit market for eggs.

Prices at New York City are the barometer that attempts to equate supply and demand for this region, and the influence of these prices extends to many other markets. On the supply side, the West North Central Region is the largest surplus producing area for eggs. Trucklot shippers in this region sell to buyers in almost all states, and in so doing they supply eggs to markets that are in need of supplies, even when the New York market has a surplus. This practice is termed intermarket arbitrage, and it has the practical effect of equating prices between markets within relatively short time periods. Another type of intermarket arbitrage is between end uses. When the egg products market is relatively higher than the shell egg market, the uncommitted supplies will move to egg breakers, and vice versa. Still another application of this principle is evident in the movement of the uncommitted supplies between outlets for current use and storage for future use. When a profit may be made by storing eggs instead of selling on the current market, eggs will be moved into storage. Similar observations could be made on poultry pricing practices.

What are the underlying factors in this complex of prices and pricing arrangements? Basically, the prices of eggs and poultry are determined by supply and demand. For these commodities, prices are determined by many buyers and sellers—not by one firm or a small group of large firms. Prices are not determined by committees or an individual. In the pricing of eggs and poultry, monopolistic control is not dominant. The allocation of the resources of production by prices is still the controlling factor in egg and poultry marketing. As the industry moves toward larger and fewer firms and integration of production and marketing functions, it will be more and more difficult to maintain this method of pricing.

Price determinants. The market price is the result of the interaction of supply and demand and is at the point where the price asked by sellers equals that offered by buyers. With a shortened supply a few buyers are willing to pay the higher prices asked by the sellers, and the market price rises. With an increase in the supply, the reverse situation is true.

Production is the basis of the supply. Distributors, by holding eggs and poultry off the market, may bring about a temporary shortage, but of course additional supplies of eggs and poultry are being produced, which must all come to the market sooner or later. Unusual weather conditions also may affect either the production or the market movement of poultry products, thereby stimulating or depressing prices.

The supply of eggs has a definite though diminishing seasonal trend,

which is reflected in relatively low spring and high winter prices. New developments such as the use of artificial lights to encourage heavier fall and winter production, earlier hatching of pullets, better housing, feeding, breeding, and cold storage warehousing tend to curtail the wide range between the spring and fall production of eggs.

As with most food products, there is a definite seasonal trend in the demand for eggs and poultry. The consumption of eggs is generally high during Lent, when egg prices are often at about their seasonal low. Since during the summer and winter months the supply of eggs becomes less plentiful, and prices advance, the per capita consumption declines.

Although the peak of the demand for turkeys, ducks, and geese is during the holiday season of Thanksgiving, Christmas, and New Year's, advertising and educational work carried on by various organizations has increased the year-round demand for them.

Good quality encourages increased consumption. Nothing is more discouraging to consumers accustomed to fine-quality, mild-flavored eggs than to be served an inferior specimen with a strong taste. Consumers are likely to lose their egg appetite, and serious price sacrifices may be required to bring them back to normal consumption.

Supply and demand factors apply to each specific grade of eggs. For example, as the quality of eggs declines during the summer, the price of lower grades is depressed. At the same time the best grades advance in price, because there is a surplus of poor eggs and a scarcity of fine ones. On the other hand, a cool spell of weather causes all eggs to be better in quality, and an adequate supply of the best grades results in a decline in their market price.

Effective supply is the supply actually offered on the market. If a truckload of 600 cases of eggs comes to the market, and 10 cases out of the lot are discarded for one reason or another, only 590 effective cases have reached the market, and the market influence is that of only 590 cases of good eggs.

Every available substitute for eggs, such as baking powder, cornstarch, flour, and milk is continually competing for the egg business of the country. Every substitute for poultry, such as other meats and cheese, is competing for the poultry trade. If eggs or poultry are relatively higher than substitute foods, the substitutes will be used. If eggs and poultry are comparatively cheaper, consumers will eat eggs and poultry.

The relationship between the general buying power of the public and the prices at which various commodities are finding a market is in some instances difficult to understand. This interrelation may be

illustrated by the water level and wave action in a pool of water. The amount of water in the pool represents the amount of money in circulation or the buying power of the public; the general level of the pool represents the price level. Waves on the surface of the pool, with their alternating crests and troughs above and below the general levels, symbolize the prices of individual commodities. As more water is pumped into the pool, corresponding to an increase in the buying power of the public, the general price level rises. The prices of individual commodities increase, but not all in the same degree. With a decrease in the total buying power, the reverse situation prevails.

In each of two successive days there may be equal quantities of eggs and poultry coming to market, but a change of sentiment among buyers and sellers causes a decided change in market prices. A general feeling of firmness encourages traders to hold back the product. This holding back necessarily causes a temporary shortage, and prices advance. If this feeling of firmness is based on actual fact, and the production gradually drops off, or, if the demand increases, these higher prices will be maintained. Otherwise the prices return to their previous point and probably fall far enough below the preceding level to offset the abnormal rise.

When the market is declining, the very decline has a depressing effect on buyers and sellers and causes additional declines which often are not justified by the fundamental conditions starting the movement. When the atmosphere clears after a decline, and the traders look at actual conditions, they usually find that the decline has gone too far, and with this conviction in the minds of most of the trade, the market reacts. Similarly, during periods of advancement, when everyone is excited by the enthusiasm and strength of the market, prices are carried too high; then, after a lull in the excitement, a reactionary effect sets in, putting the market back a certain proportion of the advance.

As prices stabilize at a higher level, some marginal buyers are eliminated which lowers the demand, brings in more marginal producers, and thus eventually increases the supply, both relative and absolute. Later, the lower demand and the increased supply result in a lower price. This lower price has the opposite effect to that of the higher price just mentioned; it increases the demand, lowers the production and the supply, and increases the price again. The above facts lead us to the following conclusions, other conditions remaining unchanged: (1) when the supply of eggs or poultry is inadequate, the sooner the price is advanced, the lower the ultimate level of price at which the demand will be satisfied, and (2) when the supply is in

excess, the sooner the price is lowered, the higher the ultimate level of price at which the demand will absorb all offerings.

In everyday practice there is no way to eliminate the almost incalculable number of pertinent influences bearing on buying power, prices, consumption, and production. The effect of prices on volume of production sets up an entirely new series of influences. Because all the above influences depend for their expression upon human behavior, we must consider, in our formula for buying power, price, consumption, production changes, all the uncertainties of human psychology, anxiety of operators to make profits or avoid losses by anticipating the markets, varieties of ideas as to the same economic conditions, and the like.

Price Variation

Egg prices will be used to illustrate how prices vary geographically, by trading levels, seasonally, and according to such factors as quality, size, and packaging. Similar price variations are readily apparent for poultry.

Geographical price variation can be observed by comparing farm prices for eggs in surplus production states with those in deficit production states. For 1958 the annual average farm prices* per dozen in selected states were:

Surplus Production States		Deficit Production States	
North Dakota	28.0 cents	Florida	45.5 cents
Kansas	30.1 cents	Massachusetts	55.6 cents
Iowa	30.3 cents	Arizona	50.3 cents

Many variables explain the differences between these prices. However, when prices for eggs of the same quality, size, color, etc., are compared, the most important factor explaining geographical price differences appears to be transportation cost to the market or from the source of supply. The egg prices shown in Table 28 reveal significant variations in price spreads between various trading levels, and in over-all farm-retail margins.

The variation in the spreads between trading levels is explained by services rendered, losses sustained, and risk assumption. At each stage of marketing, services are performed that add to the time, place, or form utilities, and no distributor can afford to perform a service

* Data from U.S.D.A., Crop Reporting Board.

Table 28. Eggs, Grade A Large: Prices per Dozen at Various Market Levels and Price Spreads in Four Cities, 1958

Item	New York	Atlanta	Chicago	Los Angeles
Prices, in cents				
Retail	67.5	61.5	57.9	57.2
To retailers	55.3	51.2	52.1	46.5
To city receivers	44.3	42.0	39.7	41.8
Farm *	38.6	35.4	32.3	39.2
Spreads				
Farm-retail	28.9	26.1	25.6	18.0
Retail store	12.2	10.3	5.8	10.7
Receiver-retailer	11.0	9.2	12.4	4.7
Farm-receiver	5.7	6.6	7.4	2.6

* Farm prices are prices received by producers at the farm in major supply areas for the cities.

Source: Condensed from reference 30 in the Bibliography.

unless it is compensated for by an increase in the value of the product.³⁰ The losses sustained are the decline in quality as the eggs move through the marketing channels and the absolute losses incurred by breakage and damage in transit and handling. Risk assumption goes along with ownership. When a particular middleman owns eggs, he may sustain a loss (or profit) when prices change. In the normal course of business, price changes that are properly charged or credited to "risk assumption" have a tendency to average out. However, individual handlers need to be prepared for unexpected losses from this source.

Seasonal variation in egg prices is familiar to almost everyone. However, the leveling out of the low spring prices and high fall month's prices is shown in Table 29. A continuation of this trend is clearly indicated as improvements are made in feeding, breeding, disease control, and flock management.

The natural tendency of the chicken to lay most of her eggs in the spring months increases the supply of eggs coming to market at that season, and prices drop. Through the years producers have been able to alter that pattern by improvements in breeding, feeding, housing, and management practices. A more even distribution of the quantities of eggs produced throughout the year has been accompanied by a leveling of the seasonal variation in prices.

Table 29. Farm Prices of Eggs: U.S. Average Price per Dozen, by Months, 1925-1929 and 1954-1958

Month	1925-1929		1954-1958	
	Price, in Cents	Per Cent of Average	Price, in Cents	Per Cent of Average
Jan.	38.6	124	39.6	105
Feb.	30.9	99	39.2	104
Mar.	24.0	77	38.1	101
Apr.	23.0	74	35.8	95
May	23.7	76	34.2	91
June	23.9	77	33.6	89
July	25.4	81	35.2	93
Aug.	27.4	88	37.7	100
Sept.	31.5	101	39.8	106
Oct.	36.7	118	39.3	104
Nov.	43.4	139	39.9	106
Dec.	45.5	146	39.7	105
Averages	31.2	100	37.7	100

Source: Computed from monthly issues of *Agricultural Prices*, U.S.D.A., AMS.

The average quality of eggs produced and marketed is higher in the spring months than later, when hot weather arrives. As a result, the spread in prices between the grades is narrow in the spring, but then it widens in the summer and fall.

Pullets usually are placed in the laying houses in the late summer or fall. At first they lay small eggs, and later their egg size increases. As these eggs come to market, the supply of small eggs soon becomes much greater than the normal demand for them. Typically, the price spreads among large, medium, and small eggs widen in the fall months and become much greater than is justified on a weight basis. At that time of the year small eggs and later medium eggs are an exceptionally "good buy" from the consumer point of view.

Eggs sold in cartons sell at higher prices than eggs sold in 30-dozen case lots. Several reasons account for the difference. In a 30-dozen case of eggs, which are 80 per cent Grade A large, there will be some Grade B, Grade C, and loss eggs. There will be some mediums and possibly even a few small eggs. To meet consumer grades the eggs

must be sized and candled, which involves a labor cost. Cartons cost 2 to 3 cents each, and the "grading loss" must be included.

Many other examples of price variations could be given. Depending on the customers, large lots of uniformly good quality may sell at the upper or lower end of a price range, whereas small lots of high quality may sell at the opposite end of the range. Prices are usually higher for delivered sales than for F.O.B. sales; and prices are higher for sales on credit than on a cash basis.

Determining Prices for Contracted Sales

Many factors are involved in making contracts for sales of eggs and poultry. Many combinations of price-determining methods are found among contracts, and various divisions of risks are worked out. The personality of the dealer comes into play: some prefer risks, and some do not; some prefer risks on the market fluctuations, others on the quality of the eggs or poultry.

Consignments

When eggs or poultry are shipped on consignment, the receiver merely acts as the shipper's agent; he does not take ownership. The commission merchant retains a certain percentage of the selling price for his services in selling and assuming the account of the purchasers. Net returns are usually made for such consignments instead of gross returns with commission and costs deducted because this method permits quicker settlements and more freedom to the receiver to take a larger or smaller margin according to market and competitive conditions.

F.O.B. and F.A.S. Sales

Free on board (F.O.B.) and free alongside ship (F.A.S.) sales are popular with many shippers. By this method all transportation charges, risk during shipment, icing charges, and trucking at destination are absorbed by the buyer. The price is usually a definite one, fixed at the time of sale, and drafts for this amount are usually drawn on the buyer.

Delivered Sales

When products are sold "delivered," the shipper or seller has the responsibility of risks during transit, and trucking, if any, to the destination specified. If a certain grade of eggs or poultry is specified on delivered sales, deterioration during transit is at the risk of the shipper.

Freight-allowed Sales

This method of selling is similar to the delivered sale, in that the shipper must pay all transportation charges; but on such sales the shippers' risk stops when he has the goods loaded for shipment. All claims except claims for excessive freight charges are matters of concern for the buyer only.

Cost-plus Sales

This is a term used for sales in which the person selling the goods is guaranteed a certain margin of profit above the cost. Its principal use is in buying eggs from country shippers. A schedule of cost items is agreed upon, and the profit is added. Buyers on a cost-plus basis assume great risks, and they ordinarily make such contracts only with reputable shippers.

Joint-account Sales

When sales are made on joint account, the seller and buyer divide all costs, risks, profits, or losses. Such sales are not so common as most of the other types; but some shippers prefer to have some interest in the truckload after it reaches the market, and therefore favor this arrangement, which is a direct compromise between shipping on straight commission and selling outright.

Contracts Based on Market Quotations

Contracts sometimes specify that prices be based on price quotations to be released later. One of the important uses for the commercial quotations at New York and Chicago is determining prices on contracts to extend into the future. For such contracts, the specific quotation should be clearly determined, and the wording should be such that, if the listing of grades is changed in any detail during the interval, there will be no misunderstanding of the contract terms.

Shippers often sell all of their volume at prices based on the quotations on the days of shipment, the days of arrival, or a certain number of days after day of shipment. The exact prices of such settlements are beyond the control of either party, but these contracts give both parties an equal opportunity to estimate the price on which the contract is to be closed. On a declining market, retailers sometimes seek protection by trying to buy at prices based on the quotation of the succeeding day. A preponderance of such sales in any market increases the difficulty of reporting an accurate quotation and is likely to put unwarranted pressure on a market reporter. A regular and

dependable quotation of market values facilitates trading and also is used in diverse ways for determination of prices.

Future Trading

The trading in egg futures can be most simply described as the making and closing out of contracts for the future delivery of eggs under the rules of an exchange. The prices arrived at by the exchange trades are the result of supply and demand forces from all over the country. Trading in egg futures on the Chicago Mercantile Exchange began in 1919, and on the New York Mercantile Exchange in 1924. However, all of the trading in egg futures is conducted on the Chicago Mercantile Exchange at present.

Any person purchasing a contract (referred to as a "long") may liquidate it by making an offsetting sale of the same item on the exchange. Likewise, anyone who has sold a contract (referred to as a "short") may close out his contract by making an offsetting purchase. Unless a contract is so cancelled before the due date, actual eggs must be transferred to fulfill its terms. Delivery on futures contracts need not necessarily be made in the city where the exchange is located but may be at numerous points in the United States from warehouses approved by the exchange. These provisions are important for avoiding price squeezes and maintaining close relationships between the futures and spot values.

Hedging. Dealing in futures is done mostly by traders interested in hedging or in speculation. These two types of trade are exact opposites. The hedger may be trading with persons engaged solely in speculative operations, and by so trading he may almost completely eliminate his own speculation.

A dealer who has a large quantity of eggs on hand and who wants to protect himself against a possible decline in price before he can sell them, has the opportunity to go into the futures market and sell an equal quantity for future delivery. When the dealer sells the actual eggs he has on hand later, he buys egg futures to close out his futures contract, and the profit or loss on his sale of futures approximately counterbalances the loss or profit on his sale of actual eggs. If one has hedged a car of eggs and the market advances, the actual eggs in the warehouse have increased in value but it will cost correspondingly more to remove the hedge; in this case the storer has hedged away his profit. However, if the market declines, the actual eggs are worth less, but the hedge can be removed at a corresponding profit, and thus a possible loss can be avoided.

Hedging has perhaps brought about a slightly higher market for

spot eggs during the spring storing season. During the spring many traders watch the spot market, and whenever, for example, September, October, or November delivery can be sold for enough premium over a good car of spring fresh eggs to cover all carrying charges with a half-cent per dozen or so to spare, they buy the spring eggs and hedge them. Traders are then in position to hold their eggs in storage and deliver them on the futures contract or sell the eggs at any favorable opportunity and close out the hedge by buying a car of "Septembers," "Octobers," or "Novembers" on the board.

The practice of hedging commercial stocks of eggs aids in financing this business inasmuch as many bankers and other financing agencies are more willing to lend upon hedged supplies than upon those that are not hedged.

Similarly hedging may be used by a wholesaler who contracts to supply actual eggs at some future date at a fixed price. He may protect himself by purchasing a corresponding futures contract.

In carrying out this hedge, the merchandiser may not want the actual quality of eggs deliverable on the futures board; he uses the futures merely for protecting himself against seasonal or unexpected price fluctuations. By closing out his futures purchase by an offsetting sale prior to the time of delivery, he then buys the quality of actual eggs needed. If he wishes, he may, of course, extend all or part of his hedge into later months, by repeating the process of futures purchasing against his future needs.

Price Cycles

In addition to the price fluctuations already considered, there are cyclical wave movements covering longer periods of time and recurring with pronounced regularity. As already mentioned, when there is a high rate of return, the industry is stimulated, and eventually the gradually increasing volume of egg and poultry production becomes too great to be absorbed by the consuming public at prices profitable to the producer. Many producers will then reduce operations or go out of business. With a shortened production, profits from rising prices tend to increase and the cycle repeats itself. The length of the cycle is determined by the quickness of the people to grasp the economic situation and by their ability to go into or out of the industry after they have made up their minds to do so. Many farmers are not particularly skilled in poultry production and must build up the business rather slowly, gradually increasing the buildings, stock, equipment, and customers.

The cycle within any one commodity is obviously complicated by

the influence of numerous other cycles in various phases of their movements. For instance, the normal cycle for egg prices seems to be about 4 years, but it is frequently difficult to detect the periods from a crest to a crest in a long-time study. Temporary or permanent changes in tariffs, rates of exchange, habits of the people, or war conditions affect the length of cycle for any commodity.

Price Forecasting

In a strict interpretation of the term "forecasting," every buyer and seller attempts to forecast prices by buying or selling today rather than waiting until tomorrow when the price may change. However, those who attempt to forecast prices are usually concerned with a longer time period. During the winter months much interest is apparent in the price level for eggs the following spring. During the spring many persons attempt to forecast the prices of shell and frozen eggs in the fall months ahead. The willingness to store eggs or produce frozen eggs is dependent largely upon the price forecast of individuals for the future. Similar examples could be given for poultry.

Those who attempt to forecast price usually examine past history to obtain a basis for future prediction. For example, in years when production is large, price is low; when production is relatively small, price is high. Variations in supply and demand, competition from other food products, and many other factors influence prices and price forecasting.

In many studies a high correlation has been found between the factors affecting supply or demand, and price. However, in estimating future prices based on past relationships an error of estimate is always present. Even though a high correlation may be obtained from past relationships, the estimate of a particular price forecast may be correct only within a reasonable range.

Another pitfall in price forecasting is the importance of a particular factor in certain years. In 1944 a surplus of eggs was produced, and it appeared that a surplus would be forthcoming in 1945. In 1945 a relatively large supply of eggs was produced, but a surplus did not develop because red meats were in short supply. In other years different factors become important and then subsequently fall back into a normal pattern.

From the point of view of an individual or a firm, the need for price forecasting is clearly apparent. In the methods used to obtain this goal past experience is only a guide. Evaluation of the factors of production and of demand still are of primary concern. Introduction

of a new factor or the larger importance of an old factor may tilt the decision one way or the other.

At best price forecasting is a risky business. Losses incurred from one wrong decision can easily wipe out gains from several right decisions. In situations where the risk is large the possibility of profit must be large also, or no one will assume the risk. When people assume risks and make a large profit in a certain year, much publicity is given to the profits made. Losses made in other years go unnoticed. The term "speculators" has been applied to those who are willing to assume large risks. However, if it were not for these individuals prices to producers would be disastrously low in certain years, and prices to consumers would be exceedingly high in other years. The speculator has been given bad publicity through years, but he continues to perform a useful economic function. He is the one most concerned with price forecasting and without his services a serious loss would ensue in keeping prices within normal limits.

MARKET INFORMATION

Current prices reflect the adjustment of supplies and demand at the present time in a particular market. However, the decision to produce a product or supply a certain market must be made in advance of the time a current price decision is made, and market information is needed in arriving at such decisions. The assessor of demand, must consider that consumers' purchases are influenced by such factors as income, the need or desire for one product instead of another, size of family, nationality background, race, religion, and traditional holidays. Marketing information on all these factors is needed. In arriving at marketing decisions to buy or sell, information is needed about the kind of product, quality or grade, size or weight, color, price, the terms of sale, and many other items.

Market information is needed by buyers and sellers at all of the marketing levels and particularly at the levels at which prices change sensitively and quickly in response to changes in supply and demand.

To meet the needs for price and other marketing information, many daily and weekly newspapers, radio stations, private organizations, and state and federal agencies attempt to provide information on production, supplies moving to market, storage holdings, movement into retail outlets, demand, and price. Some of this information is provided daily, whereas other aspects are provided weekly, monthly, annually, and at 5 or 10 year periods by the census.

DAILY MARKET REPORTS

Daily market reports are issued for shell eggs, egg products, live poultry, and processed poultry. Most of these reports cover trading levels from prices paid producers to prices paid by retailers. They include spot or current market prices, sales to the military, and prices of future contracts. The list of cities and producing areas covered is fairly long, and it varies for each of the commodities. In addition to prices, information is given on supplies moving to market, receipts, storage holdings, and demand.

Daily reporting of the market includes reports of public sales with the grade and price, the range of prices obtained in private sales for specific grades, and an opinion of market conditions such as strength or weakness. All this is of interest to producers and dealers outside the market, who attempt to analyze conditions in the market and anticipate price trends. Sometimes an opinion of the market is given early in the morning before the final report is ready, and this is sent out as an early telegraphic flash. Subscribers to commercial reports may receive this early morning report in advance of the final quotations about noon, and it guides them in their business during the day.

In New York, Chicago, Boston, and from time to time in other cities, market reporting is performed by private concerns and also by the Market News Service of the U.S. Department of Agriculture. The private agencies receive an income for their work by selling their reports to individual subscribers (by mail, telephone, and wire transmission), to newspapers, to news distributors such as the telegraph company and radio stations, and by publishing them in daily and weekly publications with a paid subscription list.

In many smaller markets where the business is not sufficient to warrant a private agency undertaking it for profit, quotations obtained from dealers are carried in local newspapers. Terminal market information received from the nongovernmental agencies, the government market news service, or a national press service may also be published.

Work of Reporters

A market reporter who undertakes to make an estimate of market values must be a man who is not biased by his own personal opinion. He must observe shrewdly, analyze keenly, and record his findings precisely. His report should be comparable to the readings of a

thermometer. Previous conditions of the market or the whirlpool of pessimism or optimism in which he may find himself on any busy market day should not affect him.

The qualifications of a good market reporter are both innate and acquired through years of experience. Every market is permeated by its own peculiar influences, and one trained in New York City would require considerable experience to be able to report the Chicago market accurately. Some of the most successful market reporting organizations have separate reporters trained for reporting the various commodities.

Definitions

Among the trade terms often used in describing market conditions, are the following:

Spot market. The market for goods available for immediate delivery; such goods are sometimes called "spot" goods.

Thin market. A market so sensitive to volume that any substantial bids or offerings are likely to advance or depress the prices.

Steady market. A market in which there is no distinct tendency for a rise or fall of prices. Values seem to be fairly well fixed at existing quotations. The market is always susceptible to sudden changes, but on a distinctly steady market, a day or two is usually required to cause much of an upset.

Firm market. This term is almost synonymous with "strong" market. It means that most people are expecting a higher market in the immediate future. Buyers are undertaking to buy ahead at the present prices, and sellers are holding off. It is distinctly a seller's market.

Weak market. The term weak is used in a sense opposite to firm. A weak market is a buyer's market. The sellers are undertaking to sell their goods at present prices and often shade the prices slightly, whereas the buyers are holding off. It usually indicates that the sales must be made at prices slightly lower than the quotation in order to start normal buying.

Easy market. An easy market tends toward weakness, with sellers generally willing to shade prices, and prices likely to decline under very little pressure.

Dull market. Other terms describing this condition are inactive, slow, listless, and quiet. It is usually a time of comparative weakness on the market. There may be no distinct weak feeling on the part of the traders, but they are waiting for developments which may change the market to a firmer or weaker condition.

Unsettled market. The traders are uneasy and values are not well fixed in an unsettled market. It must be watched closely, for traders are anxious and are easily affected by rumors or changing conditions.

Nervous market. Just as the term indicates, this is usually a situation in which the traders expect a sharp break momentarily and are easily influenced by rumors.

Irregular market. On an irregular market, values cover a wide range, and the prices realized for identical grades of eggs or poultry may be very different, as different traders have different ideas of market values. This condition of the market is very similar to the condition termed unsettled, and values are likely to change at any moment.

Demoralized market. This term is used occasionally when severe breaks in market prices cause the traders to lose their balance to such an extent that no one knows just where values lie. Some traders may cut prices recklessly in order to force sales, thus driving the price below its normal level; other traders hold their eggs or poultry off the market, sometimes fearing that they may accept lower prices later, but waiting to see if such withholding of the product will stop the decline and start a reaction. The expression "bottom dropped out of the market" is characteristic.

Inside and outside quotation. For a grade quoted 25 @ 27, the inside or lowest quotation is 25, and 27 is the outside quotation or top quotation for the respective grade. Such a quotation indicates that the market reporter has found that particular grade selling at various prices within the range quoted.

Above or below the quotation. Prices of eggs or poultry are frequently specified at a certain amount above or below the quotation. This is a careless method of pricing, since it is not always clear whether the price is above or below the outside quotation, the inside quotation, or the average of the two. The usual interpretation of such a price is to consider that "quotation" means above the outside quotation, whereas "below" means below the inside quotation.

Average quotation. As the term indicates, average quotation refers to the average of the inside and outside quotations.

Reporting the New York Market

Reports from the New York City market are of especial significance to the rest of the country. This market constitutes the largest consuming center for eggs, dressed poultry, and live poultry in the world. Although special conditions such as storms, heat waves, or a sudden development of optimism or pessimism by the trade in any

substantial market such as Chicago, St. Louis, Boston, or Philadelphia might have a temporary influence, the New York market sooner or later regains its price-indicating import. Two agencies now issue reports covering the New York poultry and egg markets, the Uerner-Barry Company and the U.S. Department of Agriculture.

The Uerner-Barry Company is a commercial price reporting and publishing firm which first began reporting the New York produce markets in 1858. This company issues the *Producers' Price-Current* (daily), private telegraphic and telephonic service by subscription, the *American Egg and Poultry Review* (monthly), *Who's Who in the Egg and Poultry Industries* (annual), *Special Market Report* (weekly), and other trade publications. This company also supplies daily reports to Western Union, some other wire services, certain newspapers and radio stations, and other agencies for transmission throughout the world. The *Producers' Price-Current* carries prices and comments for the New York market, as prepared by its own market reporters. It also includes some of the receipts, production, storage, and other statistics compiled by the U.S. Department of Agriculture, as well as market prices and statistical data for certain groups of markets.

National Reports

Reports issued by the Dairy and Poultry Market News Branch of the U.S. Department of Agriculture, a government market news service established in 1918, include prices of poultry and eggs reported in 56 terminal markets and producing areas throughout the country. All offices are connected by an 11,000-mile leased wire teletype service. The reporters obtain information from approximately 3,000 dealers, processors, transportation concerns, warehouses, and the like across the United States. The reports include private sales and sales on exchanges where that information is available. In addition to price reporting, the government service includes statistical information regarding receipts at primary and terminal markets, storage holdings, movement into retail outlets, and other market data. This information is widely used by the industry and by poultry and egg trade journals and other publications.

Weekly reports. Because of the relatively high cost and physical problem of bringing data together from many or all states, it is practical to issue some reports only once a week or once a month.

Weekly egg and poultry market review. This report is issued each week at several cities by the Dairy and Poultry Market News Branch.

U.S.D.A. It contains a summary of the markets for the previous week and summaries of the following weekly reports:

1. Receipts of eggs at Eastern egg auctions.
2. Receipts of eggs at Pacific coast primary markets.
3. Commercial egg movement report. This report gives regional figures on receipts of eggs from farmers and deliveries of eggs to egg breakers.
4. Receipts of shell and frozen eggs at 11 terminal markets.
5. Cold storage stocks of shell and frozen eggs in 4, 10, and 35 markets.
6. Egg movements into retail channels in 4 cities.
7. Wholesale egg prices in 3 cities, and farm prices at Iowa and northern Ohio.
8. Chicks placed and eggs set in 22 areas.
9. Purchases of commercially grown young chickens in major production areas.
10. Commercial poultry slaughter report, which includes slaughter of young chickens, hens and cocks, turkeys, ducks, and geese in all plants of the United States that slaughter 30,000 pounds per week on the average while in operation.
11. Receipts of processed turkeys and other poultry at 11 terminal markets.
12. Cold storage stocks of processed turkeys and other poultry at 4, 10, and 35 markets.
13. Live poultry prices paid at the farm in several areas.
14. Wholesale prices for processed poultry in several terminal markets.

Some of these weekly reports are prepared by other agencies of the U.S. Department of Agriculture, but the *Weekly Egg and Poultry Market Review* is a convenient source which summarizes them.

Monthly reports. Monthly reports usually give more detail than weekly reports, that is, information is given by states as well as regions, or a greater breakdown is given by breeds of poultry or kind of product.

Data for monthly reports is gathered by the Crop Reporting Board, U.S.D.A., and its reports are free to the public on request. Only the egg and poultry phases of these reports are discussed.

1. *Crop production.* This report gives total eggs produced by states, number of layers on hand during the months, and eggs per 100 layers.

2. *Agricultural prices.* Prices received by farmers by states for farm chickens, commercial broilers, all chickens, eggs, and turkeys, and prices paid by farmers by states for poultry, feeds, chicks, and poults are reported. Reported also are parity prices and ratios such as the egg-feed ratio.

3. *Hatchery production.* This report gives the number of chicks hatched (both broiler and nonbroiler) in commercial hatcheries, poults hatched, eggs set, and chick and poult prices. These data are followed closely by those who are interested in learning whether the current hatch is early or late and the implications on future prices.

4. *Cold storage report.* This report gives the total quantities of eggs and poultry in cold storage at the end of each month. The total quantities held and the month-to-month changes in cold storage holdings influence current and future prices.

5. *Egg products—liquid, frozen, and solids production.* This report gives the production of egg products by classes of product and utilization during the preceding month.

6. *Poultry—canned and processed foods eviscerated under federal inspection.* This shows the quantity of poultry used in canning and other processed foods and poultry eviscerated under the U.S. Department of Agriculture inspection service.

Other reports. Many other reports are issued that are of interest to those seeking market information. However, space limitations prevent discussing all of them, and only a few will be mentioned briefly.

“Intentions” reports are issued at certain times during the year. *Intended Purchases of Baby Chicks*, issued in February, gives a clue to farmers’ intentions to increase or decrease the size of their flocks. A report of farmers’ intentions to hold turkey breeder hens is issued in October, which gives an early indication of the size of the next turkey crop.

The Poultry and Egg Situation is issued six times each year by the U.S. Department of Agriculture. It analyzes current trends in production, supplies moving to market, storage holdings, consumption, and prices. Historical comparisons and predictions of future trends are made.

Annual reports which contain a great deal of useful information for historical comparisons are:

1. The farm production, income, and disposition reports for turkeys, and chickens and eggs, issued by the Crop Reporting Board, U.S.D.A.
2. *Dairy and Poultry Market Statistics* issued by the Dairy and Poultry Market News Branch, U.S.D.A.

3. 1957-1958 Yearbook, issued by the Chicago Mercantile Exchange, Chicago.

Questions

1. What are the price determinants for eggs and poultry?
2. What are the reasons for price variations in egg quotations?
3. What are the price spreads per dozen at the different trading levels in the two cities listed in Table 28 which are nearest to your home?
4. What is hedging?
5. Define five terms used in the poultry and egg market reports to describe market conditions.
6. What is an inside and outside quotation?
7. What agencies render daily market reports, and how may they be obtained?
8. What is the value of weekly and monthly egg and poultry reports to the producer? To the buyer?

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Promotion and Advertising

The progress of the egg and poultry industry of the future will be determined very largely by the ability of that industry to market a maximum quantity of its products at reasonably profitable prices. Experience has shown that the production aspect of the egg and poultry industry is normally equal to its market needs and can adjust quite rapidly to meet the requirements of a widely varying demand. In this connection, however, it is of special interest to note that, during these adjustment periods, there are times when eggs and poultry may be sold in substantial quantities at prices that vary widely from the normal economic pattern. But, in the long run, both volume and price will adjust to a point that yields a reasonable production and distribution return to the operating interests. Thus, demand plays a very important part in determining the ultimate size of the egg and poultry industry.

Eggs and poultry have always been an important part of the human diet. Present day nutritional knowledge indicates that their importance as health and energy foods is showing a steady increase, with very good prospects of a future continuation of this trend. The basic factors that favor improved conditions along this line for the future of the industry are: (1) eggs and poultry are needed in the human diet, (2) they are usually liked by most people, (3) they can be produced quickly and in very large quantities, and (4) their cost of production is such that they can be sold at relatively economical prices (Fig. 73).

The four products in principal volume of the egg and poultry industry are eggs, chickens, turkeys, and ducks. Fortunately, for the industry interests, all four of these products share a position of favor in the field of food and nutrition. They have this advantage because they are important to a varied, nutritionally adequate diet. This advantage will undoubtedly affect the size of the industry of the future because it will influence changes that will tend to follow similar changes in population size. With good prospects of population in-



Eggs Belong

in everybody's breakfast



and add appeal to any meal



Fig. 73. Reproduction of a four-color poster designed to appeal to all ages and encourage use of eggs. Used in whole and part for reproduction in magazines and general display. (Courtesy Poultry and Egg National Board, Chicago, Ill.)

creases in the immediate future, this factor alone should account for an expansion of the industry at about the same percentage rate as the change in human population.

During the past decade, there has been a greater percentage increase in the production and consumption of poultry than there has been in the human population, which means a higher per capita consumption figure for the poultry industry. From all indications, this industry has not as yet approached its economic limitations, and the same is probably true of its future possibilities in the nutritional field.

There are two basic ways of increasing the consumption of eggs and poultry. One is to lower the cost of the product at the consumer level. The other is to influence consumers in favor of using more of the products, or, if they are not users, to arouse their interest to the point at which they will become active consumers of eggs and poultry. The first method approaches the problem from the supply, or production viewpoint, whereas the second provides for greater product use by increasing consumer demand.

The supply aspect of the problem is not fully covered in this chapter, because it is one that is primarily concerned with reducing costs of production and distribution. Thus it belongs to the husbandry phase of the poultry business and to the processing and distribution fields.

The egg and poultry industry's market approach to the problem of increasing the use of its products is one that concentrates mainly on demand. The basic objective of a demand approach, from the industry point of view, is to influence people in favor of increasing their use of these products. Thus, the appeals used by the marketers to influence consumer demand must be highly persuasive and must stress points that contain the greatest consumer appeal. For example, if the current trend is featuring the selection of food for better health, the health approach would most likely be the proper one to consider at that particular time. There are others, of course, that might be used, such as taste, economy, convenience, and price.

The bulk of the egg and poultry industry's effort to stimulate demand is made through two principal industry interests—the commercial advertisers, whose appeals are intended to influence consumers in favor of a particular brand of product, and the specialized industry promotion agencies that work to increase the acceptance of eggs and poultry in general.

The commercial firms that advertise the products of the egg and poultry industry probably reach the largest group of consumers. The individual commercial firms' main interests are, and rightly should be,

in promoting their company brand for the purpose of getting a profitable share of the existing current volume of business.

INDUSTRY'S SUPPORT OF EGG AND POULTRY PROMOTION

Effective industry promotion can be accomplished through the efforts of commercial firms that incorporate general industry promotions material in their regular advertising copy and in other parts of the firm's promotional program. However, there is a very definite economic limit to which an individual firm can continue on a sound business basis in the field of industry-wide promotion of the kind that goes beyond the firm's own specific business interests. A nominal amount of activity of this nature is often very beneficial to the business interests of the firm involved, but excessive industry-wide promotion on the part of an individual firm can give its competition more than a fair share of cost-free advantages in helping develop new business. This practice would be almost the equivalent of paying a part of the competitor's advertising bill.

For example, a firm that markets eggs and poultry may spend considerable money, within its market area, conducting consumer classes to encourage the consumption of greater quantities of these products. When the firm has satisfactorily completed its pioneer project and has the people using more of its products, the area is likely to become the center of more competitive market activity. As each competing firm learns that new business has been developed in that area, it will try to obtain as much as possible of the new business for itself. Usually, the competing firm will react by building its promotions program exclusively on brand, rather than on general products appeal. The competitor's sales subsequently may increase. If they do, the profit will be largely at the expense of the pioneering firm, and comparatively little is likely to be contributed toward furthering the area's market development and expansion for the general product involved.

The primary business interest of any firm engaged in producing or marketing a product or service related to the egg and poultry industry should be to promote its own brand or firm name, in order that it may obtain its proper share of the currently available business. However, as an active part of the total industry, the firm will probably find it advantageous to support the industry's organizations that work to increase the over-all acceptance of eggs and poultry. It is generally accepted that commercial firms will advertise the merits of their products and encourage public acceptance of their specific brand. At

the same time, general egg and poultry promotion, carried on by the industry as a whole, is calculated to expand the use of all poultry products, thus creating a broader and larger market to be reached by brand advertising.

Studies of the amount considered to be a fair share for participation in general industry promotion indicate a figure that, for the individual firm, is often considered to be comparatively low. But, when this amount is combined with similar amounts from the many other industry interests, it provides a fund that is large enough to do an effective promotions job. The actual amount usually ranges between one-tenth and one-hundredth of one percent of the firm's gross volume of business. The determination of the amount within this range depends primarily upon the firm's rate of capital turnover. The firms that have a comparatively slow turnover usually base the amount of their payments upon the higher percentage.

Promotion Agencies

In addition to the general trade associations discussed previously, which often cooperate actively with promotional programs, the egg and poultry industry has several national, regional, and local organizations that devote all or a major portion of their effort and time to the task of obtaining favorable publicity for egg and poultry products. Their primary objective is to stimulate greater consumer demand of the type that will encourage consumers to purchase and use more egg and poultry products. The need for this type of activity is in line with the trend of the times, in which it has been demonstrated that advertising and other kinds of promotion are needed to obtain acceptance of a large quantity of product. Commercial studies of many successful businesses have shown that these firms have been able to disprove conclusively the age-old statement that, "If you build a better mouse trap, the world will beat a path to your door." In practice, these businesses have learned that if you do not publicize your product, even though it may be the best, its acceptance, instead of increasing, may decline.

Another erroneous idea that has tended to retard the rate of expansion in the egg and poultry industry is that the size of the human stomach, which prevents people from eating an appreciably greater amount of food than they are now eating, renders useless the promotion of foodstuffs. Consumption of food products, however, represents an annual expenditure of approximately seventy billion dollars. Changes are constantly taking place in the food industry, and segments

of the industry that promote their products are the ones that can expect the largest percentage of consumer acceptance.

Experiences and promotions problems. Prior to the formation of the first nationwide egg and poultry promotions group, there were several local and regional attempts at general industry promotion. Most of these centered their activity around the promotion of eggs. Their principal problem was invariably a lack of sufficient funds to operate their program on a full-scale basis. All of these earlier projects were financed by voluntary funds. They were started in a small way and, at first, operated in a comparatively small area with the hope of eventually expanding to the point of complete national coverage. Soon after starting active operations, they invariably encountered the double problem of conducting an active promotions program and the task of collecting operating funds. Often it was found that so much time and effort was required for fund collection that the amount of time and effort given to the promotions program was greatly limited.

State and regional promotion limitations. Experience also taught that promotion on a state or regional basis is often excessively costly, because promotions effort that attains the desired results normally increases the market price. Higher prices in the area, affected by the promotion, quickly brought large quantities of additional product into that particular point. In most cases, the in-shippments were too great, creating a surplus and temporary low-price situation in the very area that had done the most to try to prevent such a condition from occurring.

Early efforts in egg and poultry products promotion. The problems of selling eggs and poultry have been in existence almost as long as those concerned with production. For many years the country store provided one of the principal market outlets for the eggs that were "over and above" the family needs of the small-quantity producers. The customary country store method of operation consisted of handling the eggs on a nonprofit basis to encourage the producers to trade with the store. This method gave producers a definite price advantage, but, unfortunately, it applied only to the sale of a limited volume of eggs for the individual producer. Each year the egg and poultry industry steadily changed in the direction of larger size flocks, which increased production and created a need for added consumption. It was, however, very important to the industry to have this additional consumption added at commercially profitable prices. In due time, some poultrymen, through their associations and with the help of their allied industry friends, started working toward the objective of stimulating increased consumption of their products.

One of the first attempts, or perhaps the first attempt, at a completely national Poultry Products Promotion Program was made by the American Poultry Association more than a third of a century ago. It consisted of action that was started by the appointment of a special A.P.A. Committee on August 10, 1921 and resulted in a decree which was finally formulated, agreed upon, and issued by the American Poultry Association in 1923. It was at that time promulgated as Article XXX of the constitution of the Association. It established the week previous to Easter as National Poultry and Egg Week. Decreeing that during this week, "Special emphasis was to be placed on the food value of poultry and eggs, with a view toward a greater consumption of same."

Unfortunately, this project was not followed by aggressive leadership and action. Two years later it was reported as being "unproductive of results" and gave way to the work of the newly organized, and more specialized National Poultry Council that put into action one of the industry's first completely national Consumer Promotion Programs.

NATIONAL POULTRY COUNCIL. This Council was organized August 9, 1924, at Chicago by poultry people who represented all phases of the industry. Its objective was "to look after all the collective interests of the poultry industry of America." During the five-year period following its formation the Council was quite active in national legislative and consumer promotion activity. Its first principal consumer project was the sponsoring of National Egg Day on May 1, 1926. This project was later expanded to "National Egg Week," which was promoted through the release of attractive color posters and other publicity aids distributed mainly through an organization of state committees.

National Egg Day and Week. The report of the 1926 National Egg Day indicates that it was an extremely successful event, with receipts of more than 10,000 Egg-Day clippings being reported by the Council. The total cost of the 1926 project was between 6 and 7 hundred dollars. Its success encouraged the Council's leaders to expand the project from National Egg Day to National Egg Week. The first event of this nature was held May 1-7, 1927, which was a period when eggs were in plentiful supply.

The National Poultry Council operated with managerial personnel working on a part-time, or volunteer, basis. Although this was an economical method, it had the very definite weakness of limiting the follow-through effort required for continued industry support.

The End of the National Poultry Council's Promotion Programs. The National Poultry Council's active promotion programs extended

from 1926 through 1931. The momentum for National Egg Week, gained during its active period, carried the program through a few more years, during which time it gradually faded into oblivion.

In the fall of 1937, a group of egg dealers used the name of the National Poultry Council in a promotions program designed to encourage the use of Grade "B" eggs (mostly eggs which had been held in storage), in the New York City market area. This program used advertising space in some of the leading New York City newspapers, but the total program was relatively small and of short duration. The National Poultry Council will be remembered mostly for its National Egg Week programs and the wide coverage they received from 1926 through 1931.

THE CONSUMER EDUCATION SERVICE OF THE UNITED STATES EGG SOCIETY. In May 1930 the United States Egg Society, an organization composed mainly of midwestern poultry and egg processors, established its own Consumer Educational Service by employing a full-time home economist and later establishing a poultry products test kitchen. The Society's statement announcing this service pointed to the fact that, "it would provide a year-round emphasis on the food values and food possibilities of eggs and poultry." Soon after this service was established, the Egg Society changed its name to the Institute of American Poultry Industries, and the name of the Consumer Education Service was changed to the Department of Food and Nutrition. The plan of this group was to extend eventually the service to national coverage. However, operating experience soon proved that a regional group encounters untold cost and volume problems when it attempts to operate on a national basis. During the ten-year period in which this service was operated, it made many contributions to the consumer aspect of the egg and poultry industry. In addition to issuing many publications and rendering many direct services, it also accumulated a vast amount of consumer education experience, which has since been used by other promotions groups. The project was disbanded in 1940 when its facilities and personnel were turned over to the newly organized Poultry and Egg National Board.

THE INTERNATIONAL BABY CHICK ASSOCIATION'S PROMOTION PROJECT. During the same period that saw the rise of the United States Egg Society's Consumer Educational Service, another group entered the egg and poultry products promotion field; this was the International Baby Chick Association. It began with a Springtime Egg Festival Program, which consisted of supplying its members with posters and other publicity material designed to accomplish a mission similar to the one that had been followed by the National Poultry Council. This

promotion was operated as a sideline project of the Chick Association. It was pushed quite vigorously during its first few years but, in due time, its glamor phase gave way to a routine operation.

THE NEW ENGLAND FRESH EGG INSTITUTE. The New England Fresh Egg Institute was a specialized, regional promotions organization designed to help produce premium prices for New England eggs. This promotion was in an area where consumers were using more eggs than local poultrymen could produce. The Fresh Egg Institute was organized March 15, 1938, when the nation was in a depression atmosphere. At this time the New England poultry industry was suffering from financial hardship, and many of its poultrymen were greatly in need of the extra returns they hoped to obtain through the development of premium-type market outlets.

The accomplishments of this project were many. It produced a number of fine egg publications that had excellent consumer appeal and conducted some good pioneer work on industry promotion throughout the schools of New England. It also promoted eggs on radio and in other mass media. Its accomplishments were many, but the results of its efforts to obtain added income for New England producers could not be accurately measured. The project undoubtedly increased egg consumption in New England, but whether the results were to the advantage of those who supported the venture is open to question.

This project, like any general industry promotion that is limited to a state or region, was forced to cope with the almost unsurmountable competitive situation that developed from production areas beyond its borders. It was one in which the local promotions group pays to create a favorable situation only to have others, who have made little or no contribution to the promotion costs, move in and capitalize on its efforts. Modern communication and transportation facilities enable distant interests to properly time the import of their product at a rate as fast, and sometimes faster, than that of the local promotions effort. This action prevents or greatly reduces the financial gains to the local producers who have supported the promotions effort.

The New England Fresh Egg Institute was disbanded in the early 1940's when it became the New England Branch of the Poultry and Egg National Board. This consolidation was an important decision on the part of those who had contributed time, effort, and money toward developing the Fresh Egg Institute. It helped the growth of the Poultry and Egg National Board, reduced, in the long-run, the tension in the industry, and also reduced actual promotions costs for all concerned.

The Poultry and Egg National Board. The Poultry and Egg Na-

tional Board, commonly known as PENB, is the oldest, largest, and most generally accepted of the national egg and poultry promotions organizations that is actively operating at the present time.

PENB was formed during 1939 and 1940. Its formation followed the Seventh World's Poultry Congress Meeting at Cleveland, Ohio in the early fall of 1939. During the planning and staging of this event, which was the first poultry congress held in the United States, all of the nation's various egg and poultry interests united more closely than they had ever done before. Twenty-eight national and regional organizations, representatives of all branches of the industry, form the board. In 1941 the annual budget for the board was \$25,000, and by 1959 it had increased to about \$300,000. In 1959 a plan for financial support from the industry by means of definite per-unit contributions from feed, egg, container, and other handlers was inaugurated with good results.

The board carries on an intensive nationwide campaign to create a better market for poultry products. Among the board's activities are the following: it maintains an experimental kitchen where home economists develop new uses for poultry products; it publicizes poultry and eggs in newspapers, magazines, educational films, and over the radio; it distributes recipe books to consumers; it stages cooking demonstrations; and it keeps key people all over the country informed as to the merits of consuming more eggs and poultry products (Figs. 73, 74, 75).

The National Turkey Federation's "Eat-More-Turkey" campaign. The National Turkey Federation had its beginning in connection with the Seventh World's Poultry Congress in Cleveland, Ohio in the early fall of 1939. It was organized as an over-all National Turkey Industry Federation and has since continued to function as such.

During the closing period of World War II, the leaders of the Federation realized that the increased turkey production, resulting from wartime demand, would have to be greatly reduced unless civilian outlets could be developed to consume turkey at the wartime rate of consumption. At their 1945 annual meeting, a program was presented that placed special emphasis on the use of heavy turkeys by hotels, restaurants, and other types of institutional users. The heavy turkeys, especially the heavy toms, which were the "bottleneck" product of the prewar turkey industry, had proven to be the ideal size for economical servings for the Armed Forces. During the remainder of 1945 and the early part of 1946, the Federation developed its "Eat-More-Turkey" campaign, which has been continued.

The Federation has since worked with the Poultry and Egg National



Fig. 74. A turkey, a goose, a duck, and a chicken prepared for the table and presented in a holiday motif. Pictures of this nature are in great demand to illustrate food and cooking articles that often appear on the ladies' pages of the daily press. (Courtesy Poultry and Egg National Board, Chicago, Ill.)

Board on the consumer aspect of the program but has employed its own advertising agency to prepare its posters, publications, and advertisements for magazines which go to the mass-feeding institutions and the restaurant trade. Most of the Federation's "Eat-More-Turkey" funds are spent through its own advertising agency channel, with the balance going to the Poultry and Egg National Board for direct consumer and other turkey promotion purposes.

The "Eat-More-Turkey" campaign has undoubtedly contributed heavily to the increased postwar consumption of turkey. The most measurable factor of this program has been the hotel and restaurant phase, which has led to a great increase in year-around commercial use of turkey.

The National Broiler Council. The National Broiler Council was organized in May 1954 for the purpose of obtaining special promotion for broilers to increase the consumption of broiler chickens. The specific program of the Council was originally to increase sales through



Fig. 75. The popularity of chicken barbecues for groups of two to thousands has spread into every corner of the country. (Courtesy Poultry and Egg National Board, Chicago, Ill.)

advertising, better research, more efficient merchandising, and greater public acceptance through publicity.

The Council, initially working with the Poultry and Egg National Board on consumer publicity for its broiler promotions program, after a few years withdrew its support from PENB and employed its own commercial agency for this work. This situation has resulted in some duplication of effort in the broiler promotions field. Support for the Broiler Council is provided, mainly, by the broiler processing interests.

Why some promotions groups have failed. A study of the problems and experiences of the poultry industry promotions groups that have discontinued operations has shown that one of their major problems has been that when promotions projects become effective they subsequently tend to become repetitive and routine in nature. The effectiveness of the program is centered, where it rightfully should be, on the consumer and not on those who support the promotions work.

Unfortunately, this procedure often leads to a decrease in funds from those who provide the money for the promotions organization. Promotions managers are, therefore, often faced with the alternatives of conducting a program that will ultimately give the industry a maximum promotions return, or one that will most likely do less for the industry and more to gain favor with those who pay the bill.

COMPETITION WITHIN THE INDUSTRY. A newly formed promotions group that operates largely on promises and plans can get almost unlimited publicity from the publications that reach most of the supporters of an established promotions organization. Thus, a new group can effectively weaken an older one by telling prospective industry supporters that new and different promotions not being provided by the older group will be utilized by the new group. The point that is often missed is the true reason why the older group is not furnishing these new and different services. Usually it is because the services they are providing with the funds available to them are of maximum importance to the industry. There are hundreds of ways of promoting eggs and poultry. The management of the promotions organization tries to select those that do the job most economically and effectively.

PENNY INVESTMENTS FOR DOLLAR RETURNS. Another harassing problem faced by promotions management is that of coping with those supporters who expect a dollar's worth of publicity for a penny's worth of investment. They often expect their promotions organization to provide such full-page ads in color in all national magazines, top television programs, and many similar promotions projects on a budget that could finance only a tiny proportion of the cost of such a campaign.

THE OUTLOOK FOR FUTURE PROMOTIONS WORK

The egg and poultry industry interests of the United States have, for almost a half century, tried various ways of promoting their products through industry action—some united and some not so well united. Most of these promotions organizations have greatly aided the growth of the industry, but many have failed to completely accomplish their long-time missions. Their failures were mainly due to inadequate support, or to the more serious problem of interindustry competition.

The egg and poultry industry is suffering the effects of these failures in the form of a lower demand than should exist in today's consumer market. In addition to this penalty, the industry members have lost

for their future the benefits of much accumulated knowledge, consumer goodwill, and experience.

There is plenty of work to be done to increase the consumption of poultry and eggs. It was a shock to the industry to learn recently that a revision of the government's egg production and disappearance statistics as related to growth of population showed that there had actually been a decline in the per capita consumption of eggs in the United States during the past decade compared to the substantial gains scored for poultry (Table 25).

The situation is made more glaring by the report of a recent survey of 1,200 women of different ages and living in different parts of the country.⁶⁴ Out of every 100 women questioned, 94 said eggs are a necessary food, 80 said eggs are economical, 89 said good eggs are always available, 95 said eggs are easy to prepare, 91 said they thought of eggs in connection with breakfast—but, only 59 said they use eggs for breakfast and only 63 said they think of eggs as a once-a-day food.

The foregoing survey was concluded, and with good reason, by the following question: "If they think they're necessary and economical and good, why aren't they using more?" That's a problem for the egg promotion workers to attack and correct.

After all the experiences the members of the industry have had with little efforts here and little efforts there, they are surely in position now to know what they want. With proper leadership (always likely to come forward in a crisis), the right method will probably prevail. It should be hoped and urged by all readers of this chapter that those in a position of influence and with the welfare of the industry at heart do what they can to promote progress, better products, and higher consumption in the years ahead.

Questions

1. What are the two basic ways of increasing the consumption of poultry products?
2. How is the poultry industry attempting to increase consumer demand for poultry products? Show evidence to back up your answer from a newspaper or a magazine.
3. How are brand names used to promote the sale of poultry products in your home town?
4. How are shares in industry promotions estimated in the poultry industry?
5. What were some of the problems encountered in the past when poultry products were promoted on a regional or local basis?

6. How does the Poultry and Egg National Board operate to promote the consumption of poultry products?
7. How does the National Turkey Federation promote the use of turkey meat?
8. Why have promotion plans for poultry products often failed to meet their original objectives?
9. How is the National Broiler Council financed?

Supplementary Reading

- National Turkey Federation, "The National Turkey Federation," *National Turkey Federation Circ.*, Mount Morris, Illinois, 1948.
- Traske, A. H., "Our President's Message," *Turkey World*, Vol. 18, July 1946.
- Weber, J., "A Handbook for Dairy Advertising," *Idaho Agr. Exp. Sta. Bull.* 279, June 1957.

The Producer as a Market Factor

THE PRODUCER'S DECISION

Basically, the farmer is trying to maximize his income by (1) producing poultry or eggs, (2) performing some or all of the marketing functions, or (3) working out the best combination of production and marketing functions for his particular situation. Some producers can increase their net returns by performing marketing functions, but others would be better off to produce more product and leave the marketing functions to those who specialize in them.

Limitations of time, personal preferences, geographical location, sales outlets available, and many other factors have a part in determining the choices facing the producer. One worker studying this problem⁸³ reports the conclusion that the constant search by consumers for better quality and more uniform quality encourages producers to find the best possible combinations whereby they can efficiently and profitably produce and dispose of their product. This worker reports that a substantial percentage of all eggs produced move directly from the producer to the consumer.

DESIRABLE PRODUCTION PRACTICES

The producer's goal is to produce and market the kinds and qualities of eggs and poultry meat that consumers demand. Many studies have been made to determine best practices for producers of market eggs.⁷⁶ The conclusions provide good reading for anyone concerned with trying to produce an egg which, with proper care, will satisfy the consumer and warrant higher-than-average returns to the producer.

Conservation of Egg Quality

Since conservation of quality starts on the farm, the following egg-quality program for producers is recommended.

1. Laying stock is important. Secure chicks from stock which has been bred to produce eggs with these desirable qualities: moderately large size, uniform shape and color, good shell quality throughout the year, and a large percentage of firm white and uniform light yellow yolk color.

2. Feed a well-balanced ration. Be sure plenty of oyster shell or limestone, grit, and water is provided.

3. Produce clean eggs: (a) keep plenty of clean, dry litter on the floor; (b) screen off dropping boards or pits with wire netting; (c) provide one nest for each five or six hens; (d) use plenty of clean nesting material; (e) keep broody hens out of nests and do not permit birds to roost in nests at night; (f) confine layers to house; (g) keep floor wires clean for cage operations; (h) gather eggs more often than once daily; (i) have clean hands and containers when gathering eggs.

4. Produce infertile eggs. Keep no male birds with the hens except when producing eggs for hatching.

5. Keep eggs cool: (a) use wire baskets or ventilated pails for gathering; (b) place eggs immediately in a clean cool and fairly moist room (a room with a temperature between 40° F and 60° F and a relative humidity about 70 per cent is ideal); (c) egg room should be kept well ventilated to assure freedom from foul or musty odors; (d) eggs should be allowed to cool thoroughly before packing; (e) precool fillers, flats, and cases.

6. Pack eggs carefully: (a) sort out the cracked, thin-shelled, dirty, small, and very large eggs for home use or pack separately; (b) pack eggs small end down; (c) pack only in clean, sound egg cases, fillers, and flats.

7. If it is necessary to clean eggs, follow the suggestions given for cleaning eggs in the next paragraph.

8. Handle eggs carefully, and market often: (a) market at least twice a week; (b) avoid rough handling and jarring; (c) protect eggs en route to market from extreme temperatures, rain, and dirt.

Cleaning eggs. Even after exercising all possible precautions too many eggs become dirty, and it is common practice to clean them on the farm or in the packing plant. Dirty eggs should be cleaned as soon as possible after they are gathered and cooled. On the other hand, if lightly stained eggs accumulate in the hands of dealers during the spring, when eggs usually run dirtier, they can ordinarily be stored uncleaned for a moderate length of time (60 to 90 days) without serious loss of quality. Cleaned eggs should be moved into consumption promptly.

Slightly stained eggs may be cleaned in small quantities by hand with an abrasive (Fig. 76) or a clean cloth dampened with a detergent-sanitizer solution. Wet washing is recommended by many for farm or plant use if certain vital principles are adhered to:

1. The wash water should be at least 30° F warmer than the eggs, and the rinse water should be slightly warmer than the wash water. This temperature avoids cooling and shrinking of the egg content and consequent absorbing of water and possible contamination through the shell.

2. A reliable detergent-sanitizer should be used in the water in accordance with the manufacturer's directions. The detergent-sanitizer formula should be in such balance that the cleaning properties of the solution are exhausted before the sanitizing properties are lost. The solution should be renewed whenever the cleaning properties are ineffective.

3. The eggs should be dried promptly after being washed. Washing on the farm may be done by hand or by machines adapted for farm use if they are available (Fig. 77). These machines may consist essentially of egg containers immersed in swirling water, or the egg container may be whirled in a container of washing-sanitizing solution. There are larger machines, both for dry and wet cleaning, particularly designed for plant use (Figs. 16, 17).

Farm-oiling and grading of eggs. Shell-protecting eggs in commercial plants has been discussed briefly on page 74. The current increase of attention to the interior quality of eggs at the time of delivery to the consumer is leading researchers and practical operators right back to the farm. It has been learned that some strains of birds lay better eggs than others do. Pullets generally lay better quality eggs than older birds. Individual birds may vary widely from the normal strain and age characteristic. It has also been learned that every hour after the egg is laid marks a change of the interior quality.

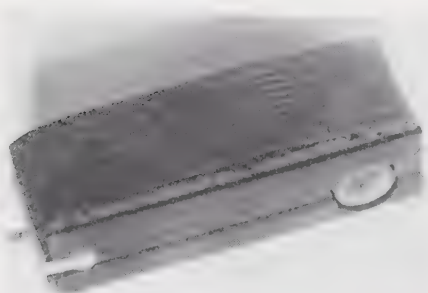


Fig. 76. Frame covered with emery paper for flicking the shell to remove slight dirt spots. This design provides opportunity for renewing the emery paper easily.

Fig. 77. Egg washer and sanitizer. Designed so plastic coated egg basket may be set into the agitator tub. Supplied with or without thermostatic water-temperature control. (Courtesy F M Engineering Co., Inc., Minneapolis, Minn.)



Among the important changes is the loss of carbon dioxide through the pores of the shell; this loss leads to a flattening and sometimes to a breaking of the yolk when the egg is opened.

Although frequent gathering and holding the eggs in a cool humid atmosphere help to retain the egg quality, it has been found that an even greater benefit results from oiling the eggs before much of the carbon dioxide has escaped.⁸³ The market distributor or other customers should be consulted before the producer starts oiling the eggs because several factors should be cleared:

1. Oiling leaves a slight gloss on the shell, and some oil accumulates on the surface of the water if the eggs are boiled. This oil should be an indication of superior quality if the customer understands what it is, but some consumers might associate it with the appearance of storage eggs, which are often oil-treated to help retain the fresh quality.

2. The best retention of egg quality is obtained by dipping the eggs in oil soon after they are laid. The dipping puts the maximum amount of oil on the shell and in the pores, and the immediate treatment entraps the maximum amount of carbon dioxide in the egg. Such eggs, however, show some gloss on the shells, the whites sometimes appear cloudy or smoky, and if the eggs are boiled for peeling (as for salads), the whites are likely to adhere to the shell membranes so they cannot be cleanly peeled. The same condition is encountered in newly laid eggs not yet cooled.

Compromised results can be obtained by using an oil emulsion (usually about 1 part oil to 3 parts water with an emulsifier), by spraying the oil on the eggs instead of dipping them, or by delaying the

*A**B**C**D*

Fig. 78. Farm-oiling eggs. A. Dipping gathering-basket into oil: B. draining oil from dipped baskets. (Courtesy Washington Cooperative Farmers Asso., Seattle, Wash.) C. Using aerosol bomb on eggs already packed (a good insecticide sprayer may also be used in this same manner). (Courtesy Poultry Tribune, Mount Morris, Ill.) D. Pressure pumps and nozzle for use as in C. (Courtesy Food Saver, Inc., Adrian, Minn.)

oil treatment until the morning after the eggs are laid or until the eggs are thoroughly cooled (Fig. 78). By these modifications the eggs can be handled so as to retain most of the new-laid quality and still avoid some of the customer objections.

3. If eggs are dipped in oil, the oil should be sterilized each day to avoid pollution. The oil should be used at a warmer temperature than the eggs and becomes an excellent medium for bacterial growth. For farm oiling, the use of a sprayer makes it possible to always use clean oil and avoid the necessity for sterilization.

As stated before, the producer would be wise to discuss the problem with his customer and perhaps his state agricultural adviser before undertaking the practice of oiling eggs. He must be sure the eggs are right before they are oiled, and he must be sure his customer wants them after they are oiled. The practice seems, at this time, to be one which will become more widely accepted in the future, if quality eggs are wanted.

Along with the practice of oiling eggs, many producers are serving large retail stores and other customers who favor the idea of the eggs being graded and packed right on the farm. This practice can eliminate all further handling of the eggs, places responsibility directly on the producer, and justifies him in expecting a maximum price for his eggs if he does the job right.

Selling eggs by vending machines. A practical egg vending machine has been developed at Cornell University.²⁶ It has been reported to operate profitably when placed at a good location and supported by fine quality eggs and effective promotional displays (Fig. 79). The average farm installation showed a profit after sales of about 99 dozen per week. Nonfarm locations did not do so well.⁴⁷

Commercial Broilers

Producers usually raise the kinds of broilers that most consumers demand. Yellow skin pigmentation apparently is more popular than white. In slaughtering and dressing the birds a few pin feathers may remain on the birds that reach consumers. Since white or light-colored pin feathers are less objectionable to consumers than black or dark-colored feathers, producers raise birds with light-colored feathers to overcome this consumer objection.

The size of broiler desired by consumers varies in different regions of the country. In New England, producers raise birds to heavier weights than in the Southeastern or South Central Regions. When producers raise birds to heavier or lighter weights than those that



Fig. 79. Note the attractive shelter providing space for display material at this installation of the Cornell Egg Vending Machine. (Courtesy Cornell University, Ithaca, N. Y.)

would minimize production costs (per pound of poultry meat produced), they are probably doing so to meet a particular consumer demand.

Turkeys

Growers raise many kinds and sizes of turkeys in an attempt to meet consumer demand. At one extreme, the heavy toms are used mainly by hotels, restaurants, and institutions. At the other extreme ready-to-cook, 4 to 8 pound, fryer-roaster turkeys are used mainly by small

families living for the most part in city apartments where ovens are apt to be small. In between, many sizes are grown to satisfy various consumer demands. In some of the recent years a price-depressing surplus of heavy toms has been produced, but in other years a relative shortage of heavy toms has developed in the spring months with storage stocks insufficient to meet the demand of the hotel trade.

MARKETING SERVICES OFTEN PERFORMED BY PRODUCERS

Producers can perform all of the marketing services or functions if it is to their advantage to do so. Producers as individuals may find it feasible to do some or all of the marketing functions when: (1) they are near cities so that they can sell to consumers or retail outlets, (2) they can satisfy some special consumer demands, (3) they or their family have spare time on their hands.

Producer-to-Consumer Sales

The direct producer-to-consumer method of selling has diminished somewhat in recent years, although it is still responsible for the marketing of a large volume of eggs and poultry. There are still some producers, especially those located within easy hauling distance of the large cities, who make special effort to sell eggs and poultry directly to the consumer, rather than through wholesale channels. Expectation of high quality and freshness has been the principal reason why consumers have consistently supported this method of marketing. In recent years, however, the quality standards of eggs and poultry, sold in retail stores, have been increased to the point at which consumers are not as dependent upon the direct producer supply as they were in former years. As poultry must be dressed, and is a more perishable product, the producer-to-consumer trade is less in poultry than in eggs.

The producer selling direct to the consumer is, in effect, performing the service which would otherwise be rendered by the wholesaler and the retailer. This service requires labor, either his own or hired, and the investment in and cost of operating a truck if deliveries are made direct.

In former years, small lots of eggs were shipped by mail or express directly from producer to consumer. Better quality eggs in retail stores and the cost of special packing and transportation have reduced very greatly the volume of product sold through this method of marketing. A study of 15 retail egg routes in Connecticut showed the costs and returns for 1953.⁵⁹ It was estimated that 354 minutes would

be required to serve 120 customers, and an additional hour would be required to load, unload, and check at the end of the day. Or, approximately 7 hours was required for a route of this size. About 200 dozen eggs (1.7 dozen per customer) and 7 chickens would be sold yielding a gross income of \$32.45 at the time of the study. Transportation cost was estimated at \$6.05 and labor was estimated at \$14.32 (\$1.79 per hour), resulting in a total of \$20.37. The difference of \$12 would be additional profit, and presumably it would cover the costs of grading and packing the eggs and killing, dressing, and cooling the poultry at the farm. It was pointed out that efficiency could be increased on the retail routes studied by (1) reducing the driving time between stops, (2) increasing the number of families served per stop, and (3) reducing the average delivery time per family. Producers who are planning to develop a retail route will find it worth their time to read this short publication.

Eggs

Producers who sell to consumers or retail stores usually clean the eggs, grade for size and quality, put the eggs in cartons, provide delivery, and sometimes extend credit. At times bakeries are interested in buying cracked eggs and undergrades. One candling light, an emery cloth for cleaning, and a simple scale is all that is needed to prepare the eggs for sale.

Poultry

Many producers kill and dress poultry of all kinds for sale to consumers and retail outlets. For this purpose a minimum of equipment can be used consisting of a chopping block and a bucket of hot water. However, producers who slaughter poultry in fairly large volumes find it is desirable to have a separate room or building in which the various operations can be performed. The facilities and equipment needed will vary according to the volume of poultry to be slaughtered and the number of operations to be performed beyond the removal of blood and feathers. Equipment manufacturers have recommendations for layouts and lists of equipment for slaughtering plants of various sizes. Also some of the Agriculture Experiment Stations and the U.S. Department of Agriculture issue publications which are helpful. Federal, state, and local laws should be checked before investing in facilities or equipment, because the granting of a license to engage in poultry processing, where required, depends in part on meeting minimum sanitary standards. Processed poultry moving across state

lines is subject to the federal government's Poultry Products Inspection Act.

A study³ of farm and small poultry slaughtering plants has resulted in the preparation of a number of floor plans. One of these is for a small farm slaughtering plant in which 3 workers can dress about 120 birds per hour, and after the birds are dressed, 3 workers can prepare ready-to-cook poultry at the rate of about 60 birds per hour (Fig. 80).

In small slaughtering plants the facilities and equipment can be relatively simple and still meet minimum sanitary requirements (Fig. 81). Funnels where the birds are placed for killing and bleeding can be mounted on a wheel to save labor. A single-drum mechanical picker can be used to remove most of the feathers from the birds. Cords can be used for hanging the birds at a convenient height for removing pin feathers. The birds can be prepared ready-to-cook on metal covered tables where a supply of water is available.

A study⁷³ of costs and returns in dressing chickens on 184 farms in New York State in 1946-1947 showed that the business seemed suited to:

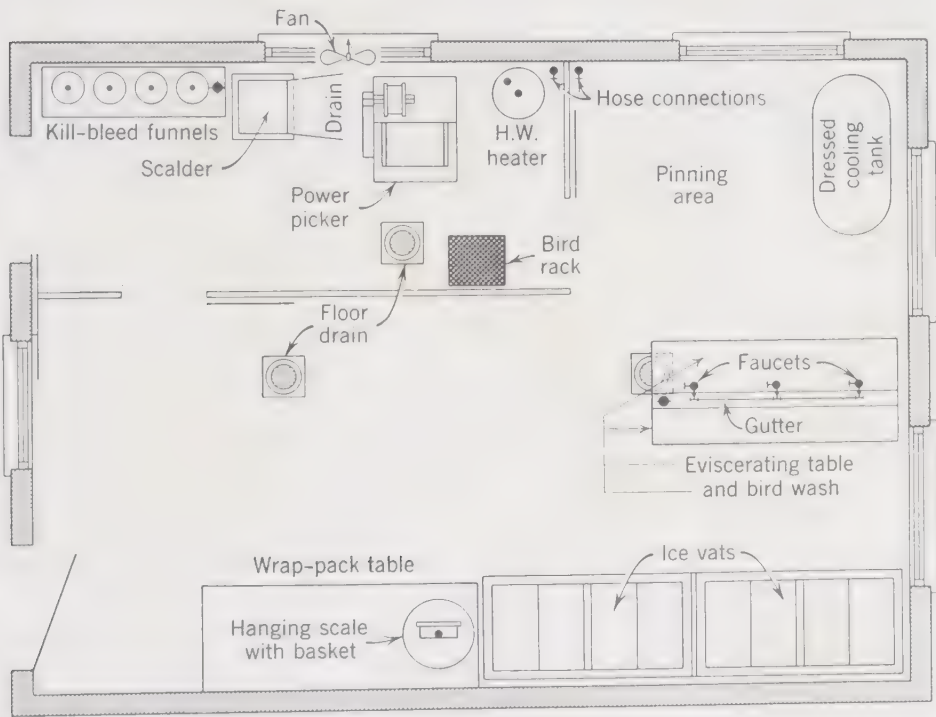


Fig. 80. Suggested floor plan for a small farm processing plant employing two to five workers. (U.S.D.A.)



A



B



C



D

Fig. 81. A, One type of funnel arrangement for holding birds for killing. A weight attached to the bird's lower mandible insures the draining of blood into the drain pan under the birds. B, A mechanical picker in a farm processing room; C, pinning the birds; D, eviscerating chickens in a small farm processing plant. (79A, 79B—Courtesy University of New Hampshire, Durham, N. H.; 79C, 79D—Courtesy Bloom's Hatchery, Shenandoah, Iowa.)

1. Those poultrymen situated near a relatively large town in which there is an area of consumers with good income who like the services such a business would provide them.

2. Those poultrymen who need to dispose of nonlaying hens which they remove regularly from the laying flock, even though the number may be small.

3. Those poultrymen who need to expand the size of their poultry business and have limited capital, as well as labor and other facilities

4. Those poultrymen who have the ability to meet consumers and merchandise their products at retail.

The author also pointed out the importance of having a correct pricing policy when poultrymen sell dressed or ready-to-cook poultry. He gave the following formula for computing the cost of New York dressed (blood and feathers removed) poultry:

Value of live chicken + per pound	Operating costs per pound of live chicken		Cost per pound of dressed chicken
		=	
Dressed weight of one pound of live chicken			

Live birds lose 10 to 12 per cent of their original weight when dressed, and the price of the dressed bird should be sufficiently higher than the value of the live bird to take the dressing loss into account. In addition, labor and other costs need to be added. In this study these costs amounted to 6.2 cents per pound for dressed poultry.

When ready-to-cook (head, feet, and viscera removed as well as blood and feathers) poultry is prepared, a further weight loss is incurred, which should be taken into account to arrive at a correct price. The formula for ready-to-cook poultry would be:

Value of dressed chicken + per pound	Operating costs per pound of dressed chicken		Cost per pound of ready-to- cook poultry
		=	
Ready-to-cook weight of one pound of dressed chicken			

Ready-to-cook birds lose about 25 per cent of their New York dressed weight, but this varies, so the actual weight loss should be checked when this operation is being performed to make certain that the correct price is determined. In the study cited above, the operating cost for preparing ready-to-cook poultry was 7.5 cents per pound above the cost of the New York dressed.

Some farmers remove the body heat of the dressed or ready-to-cook birds by putting them in vats of cold water or in milk coolers. Some wrap the birds in a plastic film and freeze them so that they can be held longer than fresh dressed poultry. Delivery to customers and extension of credit, are services that are also provided by some.

FARMER COOPERATIVE MARKETING ASSOCIATIONS

Producers can and do join together to perform marketing services which they cannot carry out as individuals. By handling larger volumes, specialization becomes feasible in utilization of labor and equipment in performing the operations and services involved in marketing. This joint action by producers may be informal or result in the formation of partnerships, business corporations, or cooperatives. Whatever form the joint action takes, its survival in a competitive economy depends upon the efficiency of performing the marketing services.

Through the years, the formation of farmer's cooperatives has been the most popular kind of joint action taken by producers. Some of these cooperatives have been so successful that they have become some of the country's largest distributors of poultry and eggs and purchasers and millers of feeds (Fig. 82). Farmer's cooperatives are organized for many purposes, and there are a number of types. Poultry and eggs are marketed for producers by many cooperatives whose main volume of business is in purchasing feed and other supplies for members. In addition to the 147 specialized poultry and egg marketing cooperatives (Table 30), over 500 cooperatives handled poultry and eggs as a secondary line of business in 1956-1957.

Types of Cooperatives

Specialized poultry and egg marketing cooperatives may be classified according to method of operating, as bargaining, pooling, auction, commission, and general.

Bargaining. This type of association acts as intermediary between individual producers and receivers in regard to prices and quality maintenance. It usually renders few services and ordinarily it does not physically assemble, handle, sell, or make payments to members. It merely supervises or acts as a bargaining agent in the selling process.⁹¹

Pooling. When growers are paid on a pool basis, all receive the same price per pound for the same grade, size, and kind of product for the pool period. The association takes title to the product and markets it to the best advantage. The length of the pool depends on supplies and demand, as well as producers' desires.⁷ Pooling has been very popular among turkey cooperatives and for cold storage operations.

Auction. Associations selling poultry and eggs by the auction method for producers usually do not take title to the product. They



Fig. 82. Aerial view of the new headquarters and general office building of the Poultry Producers of Central California at San Leandro, Calif. This plant contains over 186,000 square feet of working space and is serviced by over 12 miles of roller conveyors, nine large electro-mechanical graders, and a console electronic loading panel for routed trucks. Eight refrigerated motor trucks bring the eggs from country stations, about 25,000 cases per week. These eggs are kept under refrigeration all the way to the retailer. Operations are in two shifts, with about 100 employees in the general offices and 250 in the balance of the plant. This cooperative also distributes about 300,000 tons of feed to its members through 6 big milling operations. (Courtesy Poultry Producers of Central California, San Leandro, Calif.)

provide facilities for receiving, sampling for grade, and selling the products. A fee is charged for these and any other services rendered. Some of these associations arrange for trucking services in picking up eggs and poultry from producers and making deliveries to customers. A few associations still sell by auction only, and others use this method of sale in conjunction with other operations.

Commission. The commission type of egg marketing operation resembles the auction type, except that individual producer lots are sold at private sale instead of over the auction block. Each member receives the gross sale price of his individual lot of poultry or eggs, less a definite deduction or commission charge.⁹¹

Table 30. Specialized Poultry and Egg Cooperatives: Number, Estimated Membership, and Estimated Business, 1921 to 1956-1957

Year	Associa- tions Listed *	Estimated Member- ships †	Estimated Business,‡ in millions of dollars	
1921	26	...	15	
1930-31	160	82,000	86	
1940-41	179	105,000	82	
1947-48	143	131,000	275	
1948-49	134	134,000	304	
1949-50	131	142,000	291	
			Gross	Net §
1950-51	126	117,000	251	222
1951-52	144	134,000	301	268
1952-53	147	128,000	329	287
1953-54	155	126,000	339	303
1954-55	150	122,170	340	302
1955-56	143	115,430	336	303
1956-57	147	120,630	283	243

* Includes independent local associations, federals, large-scale centralized associations, sales agencies, independent service-rendering associations, and subsidiaries whose business is distinct from that of the parent organization.

† Includes members, contract members, and shareholders, but does not include patrons not in these categories.

‡ In addition to poultry products, includes other farm products marketed, farm supplies purchased by patrons, and service revenue.

§ This figure represents value at the first level at which cooperatives transact business for farmers. It does not include wholesale business of farm supply cooperatives with other cooperatives or terminal market sales for local co-operatives.

Source: see reference 71 in the Bibliography.

General cooperatives. Whereas the limited-activity cooperative groups mentioned previously often meet a specific problem of the producers satisfactorily, many of the most successful operations have been incorporated with broad powers to do business in any manner the board of directors and the membership may direct from time to time. Some of the first cooperative efforts of poultrymen were for the purchase of feed and supplies. Many of the cooperatives have developed large elevators and milling facilities particularly adapted to their

needs. Most of the poultry and egg marketing cooperatives carry on their processing and sales activities along with feed and supply servicing for their members.

Regional and national federations of marketing and purchasing cooperatives have proven successful in many instances where the common interests cover the wider areas.⁵⁵

Many other businesses are finding that the cooperatives become valuable customers for their services, or sources for their needed supplies, and are developing a division of their business around that fact. Examples of the former are found among brokers, insurance agencies, truck operators, and manufacturers of specialized equipment for handling eggs and poultry. Examples of the latter are canneries, chain stores, supermarkets, and produce dealers.

Commodity Marketing Associations

Many associations are conceived and developed for the marketing of one particular commodity. Examples of these are the special egg, broiler, duck, and turkey operations in various localities. Such groups usually set up standards of quality for their product, adopt brand names, publicize uses, and often engage in processing and distributing. As an example of this sort of activity we shall consider the work done by the turkey growers.⁷

Turkey marketing cooperatives have operated successfully and advantageously for many turkey growers and have made important contributions to the general improvement of turkey production and marketing. They now serve nearly every important producing section of the nation. Turkeys were first marketed cooperatively in 1918. By 1936, the number of cooperatives marketing turkeys reached 115. After 1936, concentration of production and a pronounced trend toward ready-to-cook processing in large-scale plants caused many small associations to cease business or to merge with others. By 1958 only 31 cooperatives, including one regional federation, were marketing turkeys. However, these 31 handled about 160 million pounds of turkeys in 1957, more than four times the volume of the 115 associations in 1936.

Most of the larger turkey associations are located in the western part of the United States, where there are large surpluses because of heavy turkey production and relatively sparse population. Some of their major accomplishments have been in increasing their processing efficiency, marketing more effectively, paying growers equitably, and providing growers with low-cost production services, packing materials, and transportation.

National Council of Farmer Cooperatives

Most of the large business cooperatives of the country are now members of this Council with offices in Washington, D. C. for the purpose of promoting or keeping in touch with legislation and other regional, state or world affairs affecting operations of the membership. The activities of the Council cover a wide field including credits, tariffs, and other international relationships, labor relations, transportation, problems of surpluses and prices, and research in all pertinent areas of study.

American Institute of Cooperation

In 1925 farmer cooperatives set up the American Institute of Cooperation as an educational institution. The objective of the Institute is to assist in bringing about a better understanding of the economic objectives of cooperatives and of sound cooperative principles and practices. The Institute furthers these objectives by working closely with land-grant colleges, extension services, vocational agriculture teachers, Farmer Cooperative Service of the U.S.D.A., state departments of agriculture, state cooperative councils, and other agencies concerned with cooperatives. An annual meeting is held, from which proceedings are published in *American Cooperation*. Other publications are also prepared and released by the Institute.

Expected Advantages to Members of Cooperatives

Basically, members join and patronize cooperatives to improve their economic status. From egg and poultry and other marketing cooperatives they not only expect more money from products sold but improved services beyond what they might receive from other agencies. Through purchasing associations they expect to obtain at lower cost, the high quality farm supplies and improved services needed in their farming operations. To make the effort worthwhile, it is the obligation of the cooperatives to provide these advantages to members by operating as efficiently as possible, building or otherwise acquiring needed facilities, developing new and improved products, expanding market outlets, and by developing leadership among farm men, women, and youth.

Members' Responsibilities to Cooperatives

Producers, as members and owners of cooperatives, have definite responsibilities to their cooperatives. They are responsible for keeping informed about their cooperative to protect their interests and to

receive the greatest economic benefits. To do this they have the responsibilities of electing capable directors, of patronizing their cooperative, of investing in the association their share of essential capital, and of participating in meetings and other activities of the association to insure that it adopts sound policies and operates efficiently.

Cooperatives in the Future

An accumulation of experience with cooperatives is causing farmers and others to recognize more accurately the true values and responsibilities of this type of business operation. Cooperative marketing is now recognized as a sound, progressive, and helpful form of business for the farmer when, to do the things he wants to do, he finds that he needs bigger volume than his own. It is a tool of the farmer which, if used properly, gives him a chance to obtain some of the benefits, with also the responsibilities and liabilities of big business, even though his individual operation may be very small.

Producers who are planning to form a cooperative will find it worth their while to obtain advice and guidance from their state agencies or the Farmer Cooperative Service of the U.S.D.A. Anyone interested in the fundamental structure of farmer cooperatives and the legal considerations involved should turn to the Appendix, page 310.

Questions

1. What is the trend in the marketing services performed by poultry and egg producers in your locality? Why?
2. Outline a program which will conserve egg quality on the farm and in marketing channels.
3. What are some of the economic reasons for and against producers processing poultry on the farm?
4. Where is the poultry meat produced in your area most often processed and why?
5. Why are many producers turning over the marketing function to cooperatives?
6. List the names and addresses of cooperatives nearest to your home, and state their function and membership requirements.
7. Visit an egg producer and describe the methods used for the care of eggs. Can you suggest methods of improvement?
8. Utilizing information from this and previous chapters, outline a program for holding the quality of eggs at a high level from the producer to the consumer.

Supplementary Reading

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Egg and Poultry Legislation

The basic economic purpose of most egg and poultry marketing laws is to create more equitable market conditions. Inequality in the market place is most often the result of misrepresentation of size, grade, or condition of product. Lawmakers normally try to improve marketing practices by enacting laws that require the sellers to present a true and complete description of the products they offer for sale.

Eggs and poultry are regulated mostly by state laws, although there are some national laws and regulations enforced by the Federal government. In some cases, the marketing of eggs and poultry is also subject to regulations by city, county, and even town ordinances that have much the same effect as laws but usually apply only to a very limited area.

Buyers usually benefit mostly from market laws and regulations, because most of these laws and regulations require true and complete descriptions of the products at the time of the market transaction. Laws of this nature often require the seller to designate undergrade products so that the buyer may readily recognize low quality conditions or defects of products that may otherwise go unnoticed.

Unfortunately, there are some egg and poultry marketing laws that contain requirements that are uneconomic, impractical, or unenforceable when operated under conditions to which they are not especially adapted. Legislation of this nature may result from copying from other areas laws that are impractical, untimely, or unsuited to the new conditions to which they are applied. Other causes include selfish motives on the part of those sponsoring the legislation, hasty or last minute compromise amendments made at the time of enactment, or occasionally, action on the part of shrewd legislators to provide some constituents with a law but, at the same time, to help others with differing interests by drafting the kind of legislation that will make little or no long-time change in the markets' current method of operation.

KINDS OF EGG AND POULTRY LAWS

There are many kinds of laws and regulations designed to control the marketing of eggs and poultry. Most of these are state laws that apply to the sale of eggs. There are, however, a number of laws applying to poultry that are concerned mainly with wholesomeness of products, cold storage holding time, cockfighting and the regulations of poultry transportation.

PROSPECTS FOR CHANGE IN EGG AND POULTRY LEGISLATION

There are production, processing, and marketing changes taking place in the present-day poultry industry that will quite likely lead to some rather pronounced changes in future egg and poultry legislation.

Characteristic of this type of change is the recent development of a mechanical device for detecting blood spots in shell eggs. If further refinement of this device produces the results anticipated by many scientists, it is possible that this new development could lead to elimination of the type of egg-grading methods that are being used today. Instead of candling for grade, it is anticipated that the egg processors of the future may employ rapid methods of mechanically removing blood spots, rots, and other defects. In connection with this operation, special effort and emphasis will be placed on production and handling methods to carry top quality eggs from the nest to the retailer and on to the consumer's kitchen without the necessity for so much handling and grading.

As far as poultry meat is concerned there are also many changes in marketing methods. Most broilers now move in fully processed form directly from the production areas into retail trade channels. Large quantities of fowl and other poultry meats are used by canners, chicken pie makers, and similar processors, who take the fowl out of the former channels of trade. This type of operation still calls for health and sanitation laws, but the need for legislation to regulate grade, size, and market quality is no longer a factor of primary importance.

Although new developments in production, processing, and marketing methods may eliminate the need for some existing laws, they could also create a new set of conditions that may require legislative

regulation. It is not possible to accurately predict the type of egg and poultry legislation that will appear in the future. It is, however, reasonably safe to say that it will quite likely vary widely from the kind of laws that have existed in the past. The enactment of Public Law 85-172 by the Eighty-fifth Congress on August 28, 1957 provided for the compulsory inspection of poultry and poultry products.

EARLY EGG AND POULTRY PRODUCTS LEGISLATION

Many of the egg and poultry laws that were in force at the start of the present century were concerned chiefly with the problems of spoilage of product. Improved methods of handling the products have greatly reduced the need for legislation of this type.

The first egg laws of this country were passed in the latter part of the nineteenth century. These laws were concerned primarily with inedible egg problems. Between 1910 and 1915 a number of laws concerned with inedibility of product were enacted. At the same time, cold storage eggs were being used more generally, and, as a result, many laws sprang up which were designed to regulate egg storage activity.

Cold-Storage Egg Legislation

The early efforts to hold quality and freshness in eggs that had been placed in cold storage were comparatively unsuccessful, and therefore some poor quality eggs were offered through market channels. A definite distaste for this type of egg developed, and soon producers and dealers, who were primarily interested in nonstorage eggs, saw an opportunity to improve their economic situation by promoting the enactment of state cold storage egg laws.

Between 1910 and 1930 almost all of the important egg-producing states enacted laws regulating the sale of cold storage eggs. During this period cold storage facilities and methods of storing eggs improved to the point at which it became difficult and, at times, almost impossible to tell the difference between short-held cold storage eggs and fresh ones of average quality. Under these conditions, the need for enforcement of cold storage laws diminished quite rapidly. During the past quarter of a century some state cold storage egg laws have been repealed and comparatively few of those still remaining on the state statute books are being actively enforced.

FRESH EGG LEGISLATION

The fresh egg laws have probably been the industry's most effective legislation during the present century. The first fresh egg law, to be actively enforced as such, was passed in 1927 when the New York State Assembly repealed its cold storage and all other existing egg laws and granted the Commissioner of Agriculture and Markets the power to establish compulsory grades and to limit the use of the word "fresh" in connection with egg sales. This drastic change in New York's egg legislation drew considerable comment from every section of the industry. Many members of the trade who welcomed the abolishment of the storage law looked with skepticism on the new compulsory grading and fresh egg requirements. During the first few years of enforcement, the New York officials encountered considerable difficulty and opposition. Violations ran high, and a sentiment of evasion rather than of compliance prevailed. However, continuous cooperative enforcement gradually changed this once seemingly unbearable law into a comparatively satisfactory piece of legislation, which, in the opinion of many, has had a definitely beneficial effect on the egg industry. It is interesting to note that the fresh egg section of this law formed the foundation upon which many of the fresh egg laws of the nation have been built.

Much of the success of the fresh egg laws has been due to the fact that they do not discriminate against out-of-state eggs. The laws also set a quality standard that penalizes all poor quality eggs and especially encourages quality improvement on the part of local producers. The fresh egg laws really perform a worthwhile service for consumers by assuring them a minimum quality standard in all eggs containing the designation of "fresh," or any name of a similar nature.

Growth of Fresh Egg Legislation

Approximately two-thirds of all states now make reference to the use of the term "fresh" in either their egg law or in the rules and regulations concerned with their enforcement. This fact indicates that the handlers of eggs place considerable value on the use of the term "fresh" in selling eggs to consumers. There are many designations implying fresh, such as: native eggs, nearby eggs, hennery eggs, new-laid eggs, ranch eggs, country eggs, quality-certified eggs, day-old eggs, new-arrival eggs, selected eggs, good eggs, extra selected ranch eggs, best eggs, strictly fresh, fresh-laid, farm eggs, guaranteed eggs, etc. In

some state laws, many or most all of these terms are spelled out in the basic legislation, whereas in others the enforcing authority is given power to handle this matter.

Standards for Fresh

Most of the early fresh egg laws specifically spelled out the standard quality requirements for fresh. These standards were: "Air cell—not over one-fourth of an inch deep, localized and regular; white, firm and clear; yolk allowed to be visible, but not plainly visible; no visible germ development." The final determination as to meeting these requirements was to be made by candling. Many of the more recent laws used the U.S. Department of Agriculture's quality standards to designate the minimum requirements for "fresh." In most states having fresh egg laws of recent origin, the laws, or the regulations, provide that eggs meeting the quality requirements for U.S. Grade AA and A may also carry the designation of "fresh."

General Guide to the Preparation of Fresh Egg Legislation

The following material is presented as a guide to those interested in preparing state fresh egg legislation of the type that will be enforceable, fair, helpful, and clear.

1. A fresh egg law should be enforceable and so drafted that it takes into account not only local producers but all parties involved in the handling of eggs from the time they are produced until they reach the consumer.

2. The purpose of fresh egg laws should be to make "fresh" mean "fresh," and not to ruin the legitimate egg dealer.

3. A fresh egg law should set up a standard for quality and disregard place of origin. The danger of having a law so worded that all eggs sold as "fresh" must be produced within the home state makes it unenforceable because it is difficult at best and, in many cases, impossible to positively determine the source of origin. On the other hand, any eggs that will meet the requirements of "fresh" are usually sold at a price level that does not adversely affect the local market.

4. A fresh egg law should be so written that it is understandable to the thousands of people affected by it. It should be specific in its content and should relate to quality factors which are easily understood by the trade and which can be measured by a designated process such as candling.

5. The most important part of a fresh egg law is a specification that requires the seller to really provide good quality when offering his

eggs for sale as fresh, whether he uses the actual word, "fresh," or similar words that imply freshness. However, it is also important to the success of the law to have the seller state size as well as quality. If the law requires that all eggs offered for sale be designated as large, medium, pullet, or small, it tends to eliminate misleading advertisements of fresh eggs at unreasonably low prices.

DISCRIMINATORY LEGISLATION

A common practice associated with both egg and poultry legislation is the matter of laws designed for the primary purpose of legislating against out-of-state competitors who have built consumer outlets through better quality product and better business methods than those provided by local sources. The difficulty resulting from this type of legislation is usually a loss of considerable business for the egg and poultry industry with little or no gain for those who sponsored the legislation.

The situation is frequently somewhat like the following: processors of either eggs or poultry, located in quantity producing areas, will develop outlets through large retail sources, such as national or area-wide chains. In most cases, this development will be carried out with a product that is of better than average quality and available in enough volume so that it can be kept uniform and provide for gradual expansion. The retail chain will expand the sale of this product by moving it through its warehouse distribution system into other states, where consumer acceptance will continue to build its volume owing to the product's favorable appearance, quality, and price appeal. In due time the extra volume will show a higher percentage of imports for the particular state involved. Although much of this extra volume will actually be the result of added consumer acceptance and increased local per capita consumption, local producers will be more likely to consider it as being a "market steal" on the part of out-of-state interests. Under these conditions, the first step that is usually considered by local poultry products interests is to seek legislation designed to keep the product out of the state by imposing unreasonable state import restrictions. Unfortunately, success along this line often results in a loss of much of the already developed market volume to local producers and marketers as well as the out-of-state interests who originally built the business.

If it is economically feasible to develop competition from local production sources, the logical way for the local interests to handle a

problem of this nature is through a competitive approach. The approach most generally used is one that concentrates on having local producers duplicate, or improve upon the production and marketing methods of their competitors. This approach to the problem often gives the local interests the advantages of location and (usually) less transportation expense, which help offset disadvantages. Thus, if they produce, process, and market as well or more efficiently than their out-of-state competition, they can gradually take over their local markets through normal competitive methods. In this way, the markets are not lost to competitive products outside the egg and poultry industry, because the original suppliers will continue to serve these markets until the local interests are in position to do the job.

If, instead of using the competitive method, the local interests resort to discriminatory legislation as a means of economic advantage, they are likely to destroy the market for all by not being able to supply the demand during the period immediately following the time the new legislation becomes effective.

IMPROVING METHODS OF HANDLING MARKET EGGS

There are a number of basic reasons why states enact egg legislation. One of these is to improve the over-all quality standards of the eggs that the people of their state produce and market. A state's average egg market quotation is usually a good indication of the average quality of its eggs. If the market is consistently below the average for the area, it indicates that in the market place the quality of most of its eggs is also below the area standard.

The enactment and enforcement of the Northeastern Fresh Egg Laws focused special attention on the need for refrigeration in the retail stores. Under these laws the seller of the eggs was responsible for their quality. However, cooperative enforcement often helped determine the true source of responsibility for the loss of quality. In many cases, it was found that considerable loss occurred in the retail stores, and the cause was usually lack of refrigeration. Retailers were, for the most part, interested in doing the things necessary to provide their customers with better eggs. Thus, when they learned that it was important to refrigerate their eggs for greater customer satisfaction, many of them started this practice and, finding it satisfactory, continued on indefinitely.

A detailed study of changes in egg-handling methods in 521 Baltimore, Maryland retail stores, illustrates this trend.^{76a} The study

showed that, during the 5-year period between 1946 and 1951, exactly 50 per cent of the stores that were not refrigerating eggs in 1946 had changed to refrigeration by 1951. The ones that had been refrigerating in 1946 were all continuing the practice, which brought the total retail store refrigeration figure to 68 per cent. The trend toward more retail stores refrigerating eggs has continued through to the present time.

Most Producers Slow to Adopt Better Egg-Handling Methods

On the producer side of the problem, progress was comparatively slow. It was hard to get a high percentage of the producers in many areas of the country to properly cool and care for their eggs. The reason for this was that most eggs were produced in small unit operations. Producers were, therefore, not always in position to see and fully understand the consumer market problems that were caused by loss of quality at the producer level. There was also considerable loss of quality on the part of hucksters and other types of egg handlers.

LEGISLATION TO IMPROVE EGG QUALITY

Egg industry interests in several states that had unusually low average price quotations concluded that the principal cause of these low prices was improper care of the eggs. Many of them, therefore, promoted state legislation that would require all egg handling interests, beyond the producer level, to refrigerate their eggs to a temperature of 60° F, or lower (Table 31, Appendix).

There were 11 states that had legislation of this nature at the start of 1959. These states are listed in the Appendix under Table 31. It will be noted that, for the most part, they are states that are located far from heavily populated centers. The majority of them are in areas where temperatures rise quite high during the summer months. It is especially interesting to note that all of these laws exempt the producer from mandatory refrigeration to the first point of purchase.

The Size and Weight of Eggs

It is important to all poultry products interests of a state to keep its shell egg size and weight requirements in line with national trade practices. Every state in the union imports or exports a portion of the eggs it consumes or produces. Thus, uniform size and weight specifications simplify trade problems, which in turn tend to reduce operating and product cost.

All but two states, Texas and Delaware, have provisions for size and weight specifications for eggs marketed at the consumer level. In

most cases, these provisions have resulted directly or indirectly from the enactment of state egg legislation. Some laws specifically designate size and weight specifications. Others assign the responsibility of promulgating size and weight to the enforcing agency, which, in most cases, is the State Department of Agriculture (Table 32, Appendix).

Size and weight specifications are especially important in states having laws that require the use of these designations in connection with the retailing and, in some cases, the wholesaling of eggs. In some states, the egg trade is not required by law to use the state size and weight specifications.

Advertising Requirements

In many states the advertisers of eggs are required to state the grade and size. This is primarily to prevent merchants and others from advertising an abnormally low price for eggs that are actually inferior in size, quality, or both. The use of the word "fresh," or words that imply freshness, is considered by many of these laws as being a grade term (Table 33, Appendix).

Labeling Requirements

Most eggs are now sold in cartons. In many states, the egg trade is required to place certain information on the cartons or on the labels attached to them. The information required most frequently is grade and size (Table 34, Appendix).

Licenses, Certificates, or Permits to Handle Eggs

A total of 33 states now require dealers who buy and sell eggs to obtain a license, registration certificate, or permit. There are also some cases in which local licenses are required by cities, municipalities, or counties (Table 35, Appendix).

Interstate Regulations

Mandatory inspection of poultry and poultry products that move in interstate and foreign commerce and in designated major consuming areas became effective on January 1, 1959. The act designating this effective date was passed by the Eighty-fifth Congress and was approved August 28, 1957. The poultry industry was permitted to start operations under this law on May 1, 1958 in the plants that were qualified and approved. Since January 1, 1959 all plants producing poultry and poultry products that move in interstate or foreign commerce have been required to have government inspection.^{86, 102}

The Food and Drug Administration has issued interpretations con-

cerning shipment of incubated and other "adulterated" eggs.^{21a} This Administration also, in 1959, limited the use of diethylstilbestrol and dienestrol diacetate in poultry feeds by preventing the sale of birds that were fed on feeds containing these products.

THE IMPORTANCE OF REPEALING OBSOLETE EGG AND POULTRY LAWS

Egg and poultry laws are usually enacted to effect a quick solution to a problem that would quite likely correct itself in due time. Consequently, laws of this nature should not be considered permanent additions to a state's legislative program. When trade customs, economic conditions, or other factors eliminate the basic need for a law, it should be repealed. It is usually much better for the legal enforcement system of a state and its poultry industry to have all obsolete egg and poultry laws repealed rather than forgotten. When an industry legislative program is kept up-to-date, it provides reasonable conditions for compliance and, thus, encourages those affected by the law to operate and cooperate with its intent and purpose.

TRADE ATTITUDE TOWARD EGG LEGISLATION

The attitude of the egg trade toward good egg legislation is far more favorable today than it was in former years. One reason for this outlook is that the standards of quality for shell eggs have now increased to the point where relatively few egg handlers find deceptive methods profitable. Intentional misrepresentation of quality was a more or less common practice among certain segments of the egg business a quarter of a century ago. The retail buyer without facilities for candling was compelled to depend upon the integrity of the seller. Early efforts on the part of some egg handlers to improve egg trading conditions through more ethical trade practices achieved a very limited degree of success. This situation presented the high quality egg dealers with competitive problems that made it very difficult for them to improve industry operating conditions or to operate on a profitable basis. Being in the minority, the high quality egg dealers also found it hard to get support for legislation that would lead to improving trade conditions.

With gradual improvement in the general egg quality standards, more dealers centered their attention on higher quality eggs. This

action eventually placed the better quality egg dealers in the majority and led to more support for the enactment and enforcement of constructive egg legislation. The egg laws that have resulted from this action have been more practical and, therefore, more enforceable. They have served the egg trade better because they have been carefully worked out by all interests of the industry to help improve the quality and the methods of handling the product.

There are now many examples of egg handling interests calling for the enforcement of egg legislation of the type that they or their counterpart of a decade or more ago would have opposed quite vigorously.

THE ENFORCEMENT OF EGG AND POULTRY LEGISLATION

Enforcement is a very important part of egg and poultry marketing legislation. In developing new laws, it is well to designate as specifically as possible the governmental agency that will be charged with the enforcement responsibility and provide special funds for the enforcement task.

Some laws, though not very well constructed, are working out reasonably well in various states owing to the efficiency of enforcing agencies that have discarded some of the more objectionable features and added more enforceable ones through proper rules and regulations. In contrast, other laws containing very promising elements have failed in effectiveness owing to indifferent enforcement.

Failure to enforce a law often penalizes reputable merchants who comply with existing legislation as a matter of business ethics. When their less reputable competition is permitted to evade without penalty, because of lack of enforcement, they gain an unfair cost or price advantage over the merchants who voluntarily comply.

SOME DO'S AND DON'TS OF EGG AND POULTRY LEGISLATION

1. Legislation should not be used as a means of giving special advantages to local producers or dealers faced with aggressive but fair competition from other states or areas.
2. It should be used only to eliminate unsatisfactory egg and poultry marketing conditions resulting from misrepresentation, deception, or other unethical practices.

3. The matter of granting support to those promoting the enactment of egg and poultry marketing legislation is especially important to the endorsers. Influential individuals and industry organizations sometimes give full approval to proposed legislative projects without full knowledge of the facts involved. Action of this nature sometimes leads to the enactment of laws that, directly or indirectly, grant special privileges to certain interests. Laws of this nature usually do the industry more harm than good.

4. All egg and poultry marketing legislation having to do with condition of product or standards of quality should provide a reasonable tolerance to prevent the possibility of unreasonable action on the part of the enforcing agency. Some of the early laws allowed no tolerance whatsoever, which permitted condemnation of an entire lot or car of the product on the basis of finding one bad or low quality egg or one undergrade poultry carcass. Many state laws now allow a total tolerance of 10 per cent, of which at least 8 per cent must be in the grade next lower and the balance covering all other defects.

5. Legislation concerning egg and poultry marketing should be brief and easy to read and understand. It should clearly state the requirements for compliance, designate the enforcing agency, and describe the penalties for violations. The large number of people who must know and obey egg and poultry laws are entitled to concise phraseology that does not require the interpretation of court decisions.

Questions

1. What is the basic economic purpose of most egg and poultry marketing laws?
2. Discuss the term "fresh" as it applies to eggs.
3. How have refrigeration laws helped to improve egg quality?
4. What agency is charged with the enforcement of egg legislation in your state?
5. Why is a reasonable tolerance allowance necessary for all egg and poultry marketing legislation?
6. What are the weight specifications for eggs in your state?
7. List the labeling requirements for eggs sold in cartons in your state and four nearby states.
8. What are the advertising requirements in regard to grade and size of eggs in your state and three nearby states?
9. Dealers who buy and sell eggs are often required to obtain a license, registration certificate, or permit. What is the requirement in New York, California, Florida, and Illinois?

Supplementary Reading

- Hamann, J., and S. Wright, "Summary of State, County and City Laws and Regulations for Marketing Poultry," *U.S.D.A., AMS 47*, 1955.
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- Taylor, G. R., E. L. Burtis, and F. V. Waugh, "Barriers to Internal Trade in Farm Products," *U.S.D.A., B.A.E.*, March 1939.
- U.S.D.A., Poultry and Egg Situation, U.S.D.A., AMS*, November 1957.

Appendix

Table 31. States Having Laws or Regulations Requiring Refrigeration of Eggs, Revised to January 1960

Maximum Temperature Permitted by Egg Handlers, Except Producers

Arizona	60°	Kansas	60°
Colorado	60°	Nebraska	60°
Georgia	60°	North Dakota	55°
Idaho	No temperature specified	Oklahoma *	Not higher than 60° nor lower than 29°
Illinois *	60°	South Dakota	50°
Iowa *	60°	Tennessee	55°

* Applies only to retailer.

Table 32. Size and Weight Specifications for Shell Eggs by Individual States, Revised to January 1960

	Ala.	Ariz.	Ark.	Calif.	Colo.	Conn.	Del.	Fla.	Ga.	Idaho	Ill.	Ind.
<i>Jumbo</i>												
Minimum net weight per doz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz
Minimum net weight per 30-doz case	56 lb	56 lb	56 lb	*	56 lb	56 lb	56 lb	56 lb	56 lb	56 lb	56 lb	56 lb
Minimum net weight individual egg (at rate per doz)	29 oz	29 oz	29 oz	25 1/2 oz (Indiv. egg)	29 oz	29 oz	*	29 oz	29 oz	29 oz	29 oz	29 oz
<i>Extra large</i>												
Minimum net weight per doz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz
Minimum net weight per 30-doz case	50.5 lb	50.5 lb	50.5 lb	*	50.5 lb	50.5 lb	50.5 lb	50.5 lb	50.5 lb	50.5 lb	50.5 lb	50.5 lb
Minimum net weight individual egg (at rate per doz)	26 oz	26 oz	26 oz	21 1/6 oz (Indiv. egg)	26 oz	26 oz	*	26 oz	26 oz	*	26 oz	26 oz
<i>Large</i>												
Minimum net weight per doz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz
Minimum net weight per 30-doz case	45 lb	45 lb	45 lb	*	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb
Minimum net weight individual egg (at rate per doz)	23 oz	23 oz	23 oz	1 11/12 oz (Indiv. egg)	23 oz	23 oz	*	23 oz	23 oz	23 oz	23 oz	23 oz

Medium

Minimum net weight per doz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz	21 oz
Minimum net weight per 30-doz case	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb	39.5 lb
Minimum net weight individual egg (at rate per doz)	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz	20 oz

Small

Minimum net weight per doz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz
Minimum net weight per 30-doz case	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb
Minimum net weight individual egg (at rate per doz)	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz	17 oz

Pee Wee

Minimum net weight per doz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz	15 oz
Minimum net weight per 30-doz case	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb	28 lb
Minimum net weight individual egg (at rate per doz)	*	*	*	*	*	*	*	*	*	*	*	*	*

* None specified.

† California law specifies that "Pee Wee sized eggs are those weighing less than 1 5/12 oz each."

Medium

[illegible]

Small

Minimum net weight per doz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz	18 oz
Minimum net weight per 30-doz case	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb	34 lb
Minimum net weight individual egg (at rate per doz)	17 oz	17 oz	17 oz	15 oz	17 oz	17 oz	17 oz	17 oz	17 oz

Pee Wee

[illegible]

*None specified.

† Average weight per doz.

Table 32 (continued)

	Nebr.	Nev.	N. H.	N. J.	N. Mex.	N. Y.	N. C.	N. Dak.	Ohio	Okla.	Oreg.	Pa.
<i>Jumbo</i>												
Minimum net weight per doz	30 oz	*	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	30 oz	28 oz	30 oz
Minimum net weight per 30-doz case	56 lb	*	56 lb	56 lb	56 lb	*	56 lb	56 lb	56 lb	56 lb	*	56 lb
Minimum net weight individual egg (at rate per doz)	29 oz	*	29 oz	29 oz	29 oz	30 oz	29 oz	29 oz	29 oz	29 oz	21 $\frac{1}{4}$ oz (Indiv. egg)	30 oz
<i>Extra large</i>												
Minimum net weight per doz	27 oz	26 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	27 oz	26 oz	27 oz
Minimum net weight per 30-doz case	50.5 lb	*	50.5 lb	50.5 lb	50.5 lb	*	50.5 lb	50.5 lb	50.5 lb	50.5 lb	*	50 lb
Minimum net weight individual egg (at rate per doz)	26 oz	26 oz	26 oz	26 oz	26 oz	27 oz	26 oz	26 oz	26 oz	26 oz	21 $\frac{1}{2}$ oz (Indiv. egg)	27 oz
<i>Large</i>												
Minimum net weight per doz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	23.5 oz	24 oz
Minimum net weight per 30-doz case	45 lb	*	45 lb	45 lb	45 lb	*	45 lb	45 lb	45 lb	45 lb	*	45 lb
Minimum net weight individual egg (at rate per doz)	23 oz	1.83 oz (Indiv. egg)	23 oz	23 oz	23 oz	24 oz	23 oz	23 oz	23 oz	23 oz	11 $\frac{1}{2}$ oz (Indiv. egg)	24 oz

Table 32 (continued)

	R. I.	S. C.	S. Dak.	Tenn.	Tex.	Utah	Vt.	Va.	Wash.	W. Va.	Wis.	Wyo.
<i>Jumbo</i>												
Minimum net weight per doz	30 oz	30 oz	*	30 oz	30 oz	28 oz	30 oz	30 oz	30 oz	*	30 oz	30 oz
Minimum net weight per 30-doz case	*	56 lb	*	56 lb	56 lb	52 lb	56 $\frac{1}{4}$ lb	56 lb	56 lb	*	56 lb	56 lb
Minimum net weight individual egg (at rate per doz)	30 oz	29 oz	*	29 oz	29 oz	27 oz	29 $\frac{1}{2}$ oz	29 oz	29 oz	*	29 oz	29 oz
<i>Extra large</i>												
Minimum net weight per doz	27 oz	27 oz	*	27 oz	27 oz	26 oz	27 oz	27 oz	27 oz	*	27 oz	27 oz
Minimum net weight per 30-doz case	*	50.5 lb	*	50.5 lb	50.5 lb	48.5 lb	51 lb	50.5 lb	50.5 lb	*	50.5 lb	50.5 lb
Minimum net weight individual egg (at rate per doz)	26 oz	26 oz	*	26 oz	26 oz	25 oz	26 $\frac{1}{2}$ oz.	26 oz	26 oz	*	26 oz	26 oz
<i>Large</i>												
Minimum net weight per doz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz	24 oz
Minimum net weight per 30-doz case	*	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb	45 lb	*	45 lb	45 lb
Minimum net weight individual egg (at rate per doz)	23 oz	23 oz	23 oz	23 oz	23 oz	23 oz	23 $\frac{1}{2}$ oz	23 oz	23 oz	*	23 oz	23 oz

Medium

Minimum net weight per doz 21 oz 21 oz 21 oz 21 oz 21 oz 21 oz 21 oz 21 oz 21 oz 21 oz
 Minimum net weight per 30-doz * 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb 39.5 lb

case

Minimum net weight individual 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz
 egg (at rate per doz) 20 oz 20 oz 20 1/2 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz 20 oz

Small

Minimum net weight per doz 18 oz 18 oz 18 oz 18 oz 18 oz 18 oz 18 oz 18 oz 18 oz 18 oz
 Minimum net weight per 30-doz * 34 lb 34 lb 34 lb 34 lb 34 lb 34 lb 34 lb 34 lb 34 lb 34 lb

case

Minimum net weight individual 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz
 egg (at rate per doz) 17 oz 17 oz 17 1/2 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz 17 oz

Peewee

Minimum net weight per doz Under 15 oz * 15 oz 15 oz 15 oz 15 oz 15 oz 15 oz 15 oz 15 oz 15 oz
 17 oz

Minimum net weight per 30-doz * 28 lb 28 lb 28 lb 28 lb 28 lb 28 lb 28 lb 28 lb 28 lb 28 lb

case

Minimum net weight individual * * * * * * * * * *
 egg (at rate per doz) * * * * * 14 1/2 oz * * *

* None specified.

Table 33. Advertising Requirements for Shell Eggs by Individual States, Revised to January 1960

State	Advertisement Must State			Grade and Size		Use of Term "Fresh Eggs" Restricted
	Grade and Size of Eggs	If Unclassified or Ungraded Eggs	Area of Production	Size of Letters	Abbreviations Allowed	
Alabama	Yes	No	No	No	*	Yes
Arizona	Yes	Yes	No	Yes	No	Yes
Arkansas	Yes	Yes	No	No	*	Yes
California	Yes	No	No †	Yes	No	Yes
Colorado	Yes	No	No	Yes	*	Yes
Connecticut	Yes	No	No †	No	No	Yes
Delaware	Yes ‡	No	No	No	*	Yes
Florida	Yes	Yes	Yes	Yes	No	Yes
Georgia	Yes	Cannot be advertised	Yes	Yes	No	No
Idaho	Yes	No	No	No	*	Yes
Illinois	Yes	Yes	No	No	No	Yes
Indiana	Yes	No	No	No	*	Yes
Iowa	No	No	No	No	*	No
Kansas	Yes	No	No	No	No	Yes
Kentucky	No	No	No	No	*	No
Louisiana	Yes	Yes	No	No	*	Yes
Maine	Yes	No ††	No	No	*	No
Maryland	Yes	Yes	No	Yes	*	Yes
Massachusetts	Yes †	No	No	No	No	Yes
Michigan	Yes	No	No	No	*	Yes
Minnesota	Yes	Yes	No	No	No	Yes
Mississippi	No	Yes	No	No	*	Yes
Missouri	Yes	No	No	Yes	*	Yes
			No	Yes	No	No

Montana	Yes	No	Yes	No	Yes	No
Nebraska	Yes	No	No	No	No	Yes
Nevada	No	No	No	No	*	Yes
New Hampshire	Yes	Yes	No	Yes	*	Yes
New Jersey	No	No	Yes	Yes	No	Yes
New Mexico	Yes	Yes	No	No	*	Yes
New York	Yes	No	No	Yes	*	Yes
North Carolina	Yes	Yes	No	No	*	Yes
North Dakota	Yes	Yes	No	No	No	Yes
Ohio	Yes	Yes	No	No	*	Yes
Oklahoma	Yes	Cannot be advertised	No †§	Yes **	*	Yes
Oregon	Yes		No	Yes		Yes
Pennsylvania	No	No	No	No	*	Yes
Rhode Island	Yes	No	No	No	No	Yes
South Carolina	Yes	Yes	Yes	No	No	Yes
South Dakota	Yes	No	No	Yes	*	No
Tennessee	Yes	Yes	No	Yes	No	Yes
Texas	No	No	No	No	*	Yes
Utah	Yes	Yes	No	Yes	No	Yes
Vermont	Yes	No	No	No	*	Yes
Virginia	Yes	No	No	No	*	Yes
Washington	No	No	Yes †§	No	*	Yes
West Virginia	No	No	No	Yes	*	Yes
Wisconsin	Yes †	Yes	No	No	*	No
Wyoming	Yes	No	No	Yes	*	No

* Not specified.

† When offered as native product it must have been produced in the state.

‡ Required only when price is mentioned—applies to size only (and not grade) in Massachusetts.

§ Only eggs of foreign origin must state area of production.

** Size of letters for grade and size must equal size of letters for price.

†† All eggs must be marked for size and grade. If they are not marked with a grade they must be marked ungraded along with the size.

Table 34. Labeling Requirements Covering Shell Eggs for Individual States, Revised to January 1960

State	Label Must State											
	Both Grade and Size of Eggs	If Ungraded or Uncandled	Area of Production	If Shell Treated	If Cold Storage	Date		Name and Address of Packer or Grader	Name and Address of Wholesaler or Distributor	Grade and Size		Seal or Stamp Required
						Candled or Graded	Packed			Size of Letters Specified	Abbreviations Allowed	
Alabama	Yes	No	No	No	No	Yes	No	Yes	No	Yes	No	No
Arizona	Yes	Yes	No	No	No	No	No	Yes	No	Yes	No	No
Arkansas	Yes	Yes	No	No	No	Yes	No	No	No	Yes	Yes	No
California	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	No	No
Colorado	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No
Connecticut	Yes	No	No	No	No	No	No	Yes	Yes	No	No	No
Delaware	No, †	No	No	No	No	Yes	No	Yes	No	Yes	No	No
Florida	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No	No
Georgia	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes
Idaho	Yes	Yes	Yes	No	No	Yes	No	No	No	No	Yes	Yes
Illinois	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes
Indiana	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes
Iowa	Yes	*	No	No	No	No	No	No	Yes	No	Yes	Yes
Kansas	Yes	Yes	No	No	No	Yes	No	Yes	No	No	Yes	No
Kentucky	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	No	Yes
Louisiana	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No
Maine	Yes	No	Yes	No	No	No	No	Yes	No	Yes	Yes	No
Maryland	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes
Massachusetts	Yes, ‡	No	No	Yes	Yes	No	No	No	No	Yes	No	No
Michigan	Yes	No	No	No	No	No	No	Yes	Yes	No	Yes	No
Minnesota	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Mississippi	No	Yes	No	No	No	No	No	No	No	Yes	Yes	No
Missouri	Yes	Yes	No	No	No	No	No	Yes	No	Yes	No	No
Montana	Yes	No	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes
Nebraska	Yes	No	No	No	No	No	No	Yes	Yes	No	Yes	No

Nevada	Yes	Yes	No	No	No	No	No	No	Yes	No
New Hampshire	Yes	Yes	No	No	No	No	No	No	Yes	No
New Jersey	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No
New Mexico	Yes	Yes	No	No	No	No	No	No	Yes	Yes
New York	Yes	No	No	No	No	No	No	No	No	No
North Carolina	Yes	Yes	No	No	No	No	No	Yes	Yes	No
North Dakota	Yes	Yes	No	Yes	No	No	No	Yes	No	No
Ohio	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Oklahoma	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes
Oregon	Yes	No **	No	No	No	No	No	Yes	No	No
Pennsylvania	No	No	No	Yes	No	No	No	No	Yes	No
Rhode Island	Yes	No	No	No	No	No	No	No	No	No
South Carolina	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No
South Dakota	No	Yes	No	No	No	No	No	No	Yes	No
Tennessee	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No
Texas	No	No	No	No	No	No	No	No	No	No
Utah	Yes	Yes	No	No	No	No	No	No	Yes	No
Vermont	Yes	No	No	Yes	No	No	Yes	Yes	No	No
Virginia	Yes	Yes	No	No	No	No	No	No	Yes	No
Washington	Yes	No	Yes ††	No	No	No	Either date acceptable	Either name acceptable	No	Yes
West Virginia	Yes	No	No	Yes	Yes	No	No	No	Yes	No
Wisconsin	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No
Wyoming	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No

* Sale not permitted.

† When a dealer candles the eggs.

‡ Incubated eggs must be marked as such.

§ Applies to size only.

** Producers may sell ungraded eggs only on premises where produced to licensed egg dealers or for export.

†† Except for foreign eggs.

‡‡ Foreign eggs only.

Table 35. Licenses, Certificates, or Permits for Egg Dealers: Requirements by States, Revised to January 1960

State	License, Certificate, or Permit			Annual License Fee			Inspection Fee or Labels Required
	Required for		Required for Dealers	Based Entirely or Partially on Volume of Business	Required for Each Truck Used in Buying and Selling Eggs	Required for Canners and Graders	
	Wholesale Handlers	Retailers					
Alabama	Yes	Yes	No	No	No	No	Yes
Arizona	Yes	No	No	Yes	No	No	Yes
Arkansas	Yes	Yes	No	No	Yes	No	No
California	Yes	No	No	Yes	No	No	No
Colorado	Yes	Yes	Yes	No	Yes	Yes	Yes
Connecticut	*	No	No	No	No	No	No
Delaware	No	No	No	No	No	No	No
Florida	Yes	Yes	No	No	No	No	No
Georgia	Yes	Yes	Yes	No	No	No	Yes
Idaho	Yes	Yes	No	No	No	No	No
Illinois	Yes	Yes	No	Yes	Yes	No	Yes
Indiana	Yes	Yes	No	No	No	No	Yes
Iowa	Yes	Yes	No	No	Yes	Yes	No
Kansas	Yes	Yes	No	Yes	No	No	Yes
Kentucky	Yes	Yes	No	No	No	No	No
Louisiana	No	Yes	No	Yes	No	No	Yes
Maine	No	No	No	No	No	No	No
Maryland	No	No	No	No	No	No	No
Massachusetts	Yes †	No §	No	No	No	No	No
Michigan	No	No	No	No	No	No	No
Minnesota	Yes	No	No	No	No	No	No
Mississippi	No	No	No	No	No	No	No

Missouri	Yes	Yes	No	Yes	No	Yes	No	No	No
Montana	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Nebraska	Yes	Yes	No	No	No	No	No	No	No
Nevada	No	No	No	...	*	...	No	No	No
New Hampshire	*	No	No	Yes	Yes	No	No	No	No
New Jersey	Yes	No	No	No	No	Yes	Yes	No	No
New Mexico	Yes	No	No	No	No	No	Yes	No	No
New York	Yes	No	No	No	No	No	No	No	Yes
North Carolina	Yes	Yes	No	Yes	No	Yes	No	No	No
North Dakota	Yes	Yes	No	No	No	No	No	No	No
Ohio	No	No	No	...	...	...	No	No	No
Oklahoma	Yes	Yes	No	Yes	Yes	No	No	No	Yes
Oregon	Yes	No	No	No	No	No	Yes	No	No
Pennsylvania	No	No	No	...	No	No	No	No	No
Rhode Island	No	No	No	...	No	No	No	No	No
South Carolina	Yes	Yes	No	No	No	No	No	No	No
South Dakota	Yes	Yes	Yes	No	No	Yes	Yes	No	No
Tennessee	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
Texas	Yes	Yes	No	Yes	Yes	No	No	No	No
Utah	No	No	No	...	...	...	No	No	No
Vermont	*	No	No	Yes	Yes	No	No	No	No
Virginia	No	No	No	...	No	No	No	No	No
Washington	Yes	No	No	Yes	No	No	No	No	No
West Virginia	No	No	Yes	...	No	No	No	No	No
Wisconsin	No §	No	No	Yes	Yes	No	No	No	No
Wyoming	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No

* Permit required when using voluntary state quality program.

† All wholesalers handling eggs under the blue, white and red state trademark must have a license issued by the Maine Department of Agriculture. The fee is \$1 and never has to be renewed. This also applies to producers packaging their own eggs under the state trademark.

‡ License required only for breakers and peddlers.

§ Required of peddlers and others selling eggs not produced by themselves.

DISCUSSION OF LEGAL CONSIDERATIONS AFFECTING FARMER COOPERATIVES

Legal Considerations

Each state has one or more laws authorizing the forming of cooperative corporations. These cover such matters as:

1. Minimum number of members required to incorporate.
2. Conditions to be included in the articles of incorporation and bylaws.
3. The state official or department with which the articles of incorporation are to be filed.
4. Fees required.
5. General powers, rights, and obligations of the cooperative.
6. Voting rights of stockholders and members.
7. Terms and conditions of membership.
8. Nonmember relationships.
9. General provisions with respect to distribution of saving or net margins.
10. Capital structure—stock or nonstock.

In addition to these requirements, provisions of certain federal statutes referring to antitrust laws, income tax, and requirements for obtaining loans from banks for cooperatives need to be considered. Until 1914 no special national recognition or status was given to cooperative marketing associations, and some organizations of farmers that endeavored to improve the condition of their members by engaging in cooperative marketing were condemned as criminal conspirators, combining in restraint of trade. Section 6 of the Clayton Act, enacted in 1914, assured nonstock associations of the right to exist, but this was considered inadequate protection from the antitrust law prohibitions. Accordingly, Congress passed the Capper-Volstead Act, February 18, 1922, which permits farmers to act together in cooperative associations, corporate or otherwise, with or without capital stock, in collectively processing, preparing for market, handling, and marketing in interstate and foreign commerce their products without violating the Sherman Antitrust Act. Such associations may have marketing agencies in common; and such associations and their members may make the necessary contracts and agreements to effect such purposes—provided, however, that such associations are operated for the mutual

benefit of the members thereof, as such producers, and conform to one or both of the first two following requirements and in any case to the third:

1. No member of the association is allowed more than one vote because of the amount of stock or membership capital he may own therein.
2. The association does not pay dividends on stock or membership capital in excess of 8 per cent per annum.
3. The association shall not deal in the products of nonmembers to an amount greater in value than such as are handled by it for members.

Six times, following the adoption of the Sixteenth Amendment (income tax) in 1913, the Congress of the United States has enacted special provisions dealing with the tax treatment of farmer cooperatives. In each instance, the distinct character of the cooperative form of doing business has been recognized. The Congress has also clearly manifested an intent to foster these self-help institutions for farmers.

The present provision, found in the Internal Revenue Code of 1954, Sections 521 and 522, provides that certain farmers' associations which qualify as provided therein may operate so as to have little or no taxable income because all profits accrue to the farmers themselves, and therefore, become a part of their individual taxable incomes. Farmer cooperatives which do not meet these qualifications, and about 40 per cent are in this category, are liable for income tax to the extent that their receipts are sufficient to permit the payment of a return on capital and to the extent that they have receipts which they are not under a contractual obligation to return to patrons.

The chief requirements for qualification for limited exemption are these:

1. It must be a farmer, fruit grower, or like association organized and operated on a cooperative basis to (a) market the products of members or other producers, or (b) purchase supplies and equipment for the use of members or other persons.

2. Substantially all its stock (other than preferred nonvoting stock) must be owned by producers marketing products or purchasing supplies through it if it is organized on a capital share basis.

3. The dividend rate on capital shares must not exceed the legal rate of interest in the state of incorporation, or 8 per cent a year, whichever is the greater, based upon the value of the consideration for which the capital share was issued.

4. Financial reserves are restricted to those required by state laws or those that are reasonable and necessary, and must be allocated to patrons unless the cooperative includes them in computing taxable income.

5. The business with nonmembers may not exceed 50 per cent of the cooperative's total business, and the purchasing for persons who are neither members nor producers may not exceed 15 per cent of the cooperative's total purchasing.

6. Nonmembers are to be treated the same as members in such business transactions as pricing, pooling, or payment of sales proceeds, in prices of supplies and equipment, in fees charged for services, or in the allocation of patronage refunds to the accounts of patrons.

7. Permanent records of the patronage and equity interests of all members and nonmembers must be maintained.

8. The legal structure of the organization must be cooperative in character and contain no provisions inconsistent with these requirements, and the association must be actually operated in the manner and for the purposes outlined in the requirements.

Certain provisions (Section 15) of the Agricultural Marketing Act of 1929, as amended, another federal statute, should also be considered in forming plans for a cooperative. This act gives a definition of a farmer cooperative that is eligible to borrow money from a bank for cooperatives. The essential provisions of this act are:

1. The association must be operated for the mutual benefit of the members as patrons.

2. The amount of member business must exceed the amount of non-member business.

3. Voting must be limited to one man, one vote; or dividends on the invested capital shall not exceed 8 per cent.

Non-Tax-Exempt Cooperatives. Rather than meet all the detailed requirements in order to maintain a tax-exempt status, some cooperatives pay a tax the same as any other corporation on money retained under the title of the cooperative, after all refunds or savings to be delegated to the members and patrons have been distributed.

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Index

- Abrasive, 45
- Activities, integration of, 27
 - market, 17
- Addled eggs, 60
- Advertising and promotion, 247
- Advertising requirements for shell eggs
 - by states, 304, 305
- Age of eggs, 61
- Air cell, 45
 - tremulous and broken, 61
 - size and condition of, 66
- Air space, *see* Air cell
- Albumen, 43, 46
 - chalaziferous layer of, 43
 - condition of, 66
 - dried, 106
 - drying, 104
 - freezing, 104
 - inheritance of thick and thin, 48
 - inner thin, 43, 56
 - outer thin, 43
 - protein content of, 43
 - riboflavin in egg, 47
 - thick or firm, 43, 56
- Allotting, 19
- American Farm Bureau Federation, 32
- American Institute of Cooperation, 278
- American Poultry and Hatchery Federation, 32
- American Poultry Association, 32
- American Poultry Historical Society, 32
- Antibiotics, 43, 142
- Assemblers of eggs, central, 24
- Assembling, 17
- Associated Poultry and Egg Industries, 30
- Associations, 32
 - commodity marketing, 277
 - farmer cooperative marketing, 274
 - state and regional, 32
- Associations, *see also* Cooperatives;
Farmer cooperatives
- Auctions, 274
- Avian pneumoencephalitis, 49
- Bacteria, 43
 - fluorescent (*pseudomonas*), 61
 - infection by, 54, 60
 - Salmonella, 103
- Baked eggs, 58
- Bench system, 84
 - push-pull, 84
- Bill of lading, order, 192
 - straight, 192
- Bleeding, 131
- Blind check, 53
- Blood, detectors, 69
 - ring, 58
 - spot, 49, 50, 51
- Blood and offal, 168
 - yields of, 170
- Bloody eggs, 51
- Body checks, (also blind or sealed), 53
- Boiled eggs, 58
- Breaking, egg, 102
- Broiler Council, National, 257
- Broiler ducklings, 121
- Broilers, commercial, 6
 - transporting, 177
 - types of, to produce, 267
- Brokers, 24
- Brown-shell eggs, 48
- Buying, 18
 - stations, 24
- Calcium carbonate, 46
 - in feed, 50
- Calcium phosphate, 46
 - in feed, 50
- Candling, 41, 48, 60
 - aids, 69

- Candling, belt, 70, 85
 - bench, 84
 - combination systems for, 85
 - electronic, 49
 - flash, 102
 - lights, 73
 - machine, 70
 - personal judgment in, 69
 - technique, 74
 - varying qualities of eggs, 69
- Canned poultry, 163
- Capons, 120
- Carbon dioxide, 75
 - gas, 131
- Carriers, common, 191
 - protective service, 191
- Cartons, chipboard egg, 82
 - clear plastic egg, 82
 - molded pulp egg, 82
 - overwrapped egg, 83
- Cases, fiber egg, 78
 - one-trip egg, 80
 - standard egg, 80
 - truck egg, 80
 - wooden egg, 80
- Chain stores, 206
- Chalazas, 43, 48, 53
- Chalaziferous layer, 43
- Checks, 63, 68
 - blind (also body or sealed), 53
- Chicken, canned, 163
- Chickens, 120
 - farm, 5
 - marketing margins and costs for, 216-223
 - packaging chilled, 157
 - stewing, 120
- Chilling, *see* Poultry, chilling
- Cholesterol in eggs, 47
- Churning eggs, 103
- Claims, transportation, 80
- Cleaning eggs, 263
 - for breaking, 102
- Cleanliness of eggs, 63, 66
- Cocks, 120
- Cold storage, egg legislation, 283
 - holdings of eggs and egg products in, 100
 - warehouses, 61
- Cold storage, watery eggs for, 49
 - see also* Storage
- Color of eggs, factors affecting, 62
 - grading for, 66, 72
 - inheritance of, 48
- Commission merchants, 25
- Common carriers, 191
- Composition of egg, 46
- Conalbumen in egg, 47
- Condition, physical, of bird, 49
- Consignments, 233
- Consumer, demand, 204
 - preferences for poultry meat by, 214
 - producer-to-consumer sales, 269
- Consumer's dollar, farmers' share in, 216-224
- Consumption, 34
 - per capita, of eggs, poultry, and meats, 214-216
 - point of, 202
- Contracts, based on market quotations, 234
 - determining prices for, 233
- Cooling, eggs, 54
 - poultry, 137-142
- Cooperation, American Institute of, 278
- Cooperative, farmer, marketing associations, 274
 - organizations, 28
- Cooperatives, auction, 274
 - bargaining, 274
 - commission, 274
 - expected advantages to members of, 278
 - farmer, 274
 - general, 276
 - in the future, 279
 - legal considerations affecting farmer, 310
 - members' responsibilities to, 278
 - pooling, 274
 - types of, 274
 - see also* Associations; Farmer co-operatives
- Cooperatives, National Council of Farmer, 31, 278
- Costs, marketing margins and, 216-224
 - for eggs, 217-220
 - for frying chickens, 221-223

- Costs, marketing margins and, for poultry, 220-224
 - for turkeys, 223, 224
 - of grading and packaging eggs, 90
- Cottonseed meal, 50
- Country stores, 23
- Cracks, 63
- Credit, 28
- Cup flats, 81
- Cuticle of shell, 45
- Cut-up poultry, 140
- Damage in transit, 193
 - handling claims for, 193
- Dead germ, 58
- Dealers, wholesale, 25
- Deficit areas, surplus-, 9, 10
- Delmarva Poultry Industry, Incorporated, 32
- Demand, 34
 - consumer, 204
- Demurrage, 190
- Dents, 63
- Deterioration of market eggs, 54
- Dirty eggs, 64, 68
- Disc, germinal, 41, 42
 - multigerminial, 51
- Distributing, 19
- Distributors, types of, 19, 22
- Distributor's service, basis of pay for, 203
- Diversion in transit, 190
- Double-yolk eggs, 50
- Dressed poultry, receipts of, 113
- Drugs, effect of, on egg quality, 49
- Drying eggs, 104
 - pan, 104
 - spray, 104
- Dry picking, 131, *see also* Feather removal
- Ducklings, 121
 - broiler or fryer, 121
 - roaster, 121
- Ducks, 8, 121
- Egg, fortified dried whole, 107
 - frozen, 99
 - licenses, certificates, or permits for, dealers by states, 308, 309
 - ovoalbumen in, 47
- Egg, ovoglobulin in, 47
 - ovomucin in, 47
 - ovomucoid in, 47
 - retail shell, packages, 82
 - solids, 99
 - use of, shells, 108
 - whole dried, 107
 - wholesale shell, packages, 78
- Egg and poultry legislation, 281
- Egg production, variations in, 211
- Egg products, exports of, 98
 - grades, standards, and inspection for, 109
 - imports of, 96
 - operations in producing, 99
 - packages for, 108
 - packing, 108
 - prices of, 95-99
 - seasonality of production of, 95-99
 - uses for, 107
 - yields and conversion factors for, 109
- Egg products industry, 93
 - location of, 95
- Egg quality, after intensive laying, 49
 - during summer, 49
 - effect of drugs on, 49
- Eggs, abnormal, 54
 - absorption of odors and flavors in, 63
 - advantages of grading, 76
 - advertising requirements for shell, by states, 304, 305
 - age of, 61
 - candled and broken-out appearance of, 41
 - cleaning, 45, 102, 263
 - composition of, 41, 46
 - conservation of quality of, 262
 - cooling, 54
 - costs of packing and grading, 90, 217-220
 - deterioration of, 54
 - effect of heat on, 56
 - exterior quality of, 62
 - farm grading of, 264
 - farm-oiling and grading of, 264
 - fertile, 42
 - flavor of, 49
 - freezing and frozen, 59, 104
 - fresh, 47, 62

- Eggs, frozen, in storage, 199
 - grading facilities for, 83
 - improving methods of handling market, 287
 - interior quality of, 47, 263
 - keeping quality of, 49
 - labeling requirements for shell, by states, 306, 307
 - liquid, 94, 99
 - marketing margins and costs for, 217-220
 - marketing services performed by producers of, 270
 - naked or shell-less, 82
 - off-flavor of, 49
 - per capita consumption of, 214
 - rough handling of, 61
 - selling, by vending machines, 267
 - shape of, 48, 54, 62
 - size and weight specifications for shell, by states, 296-303
 - size of, 48, 62, 211
 - soundness of shell of, 63
 - standards for fresh, 285
 - storage, 61
 - structure of, 41, 42
 - systems for grading and packing, 83-85
 - transportation of, 174-193
- Electronic candling, 49
- Embryo, 41
- Enzymic action, 47
- Evaporation, 45, 59
- Eviscerating, 143
- Exchanges, 28
- Exports, 12
 - of egg products, 96
- Express for transportation, 190
- External conditions influencing quality, 54
- "Fancy Fresh" eggs, 77
- Farmer cooperative marketing associations, 274
- Farmer cooperatives, legal considerations effecting, 310
- Farmer Cooperatives, National Council of, 31, 278
- Farmers' share in consumer's dollar, 216-224
- Farm-oiling and grading eggs, 264
- Fatty substances in yolk, 47
- Feather removal, methods for, 131
- Feathers, 165
 - uses for, 165, 167, 168
 - yields of, 170
- Federal Packers and Stockyard Act, 117
- Feed, 41, 45, 50
 - calcium carbonate in, 50
 - calcium phosphate in, 50
 - magnesium carbonate in, 50
- Fertile egg, 42
- Fillers, egg, 81
- Financing, 18
- Fishy flavor of eggs, 49
- Flats, cup, 81
- Flavors, absorption of, in eggs, 63
 - of eggs, 49
- Flock, size of, 4
- Forecasting, price, 237
- Foreign trade, 11
- Fowl, 120
- Freezing, eggs, 59, 104
 - poultry, 142
- Freight forwarding, transportation by, 190
- Fresh eggs, 47, 62
- Fryer, ducklings, 121
 - turkeys, 120
- Fryers, 120
- Frying chickens, marketing margins and costs for, 221-223
- Functions, integration of market, 27
 - market, 17
- "Future" sales and trading, 29, 235
- Geese, 8, 121
- Germ, dead, 58
- Germinal disc, 41, 42
- Glassy eggs, 46, 53
- Glycerides in yolk, 47
- Gossypol, 50
- Governmental services, 30
- Grade, predetermination of, 76
- Grading, 17
 - eggs, 66, 76
 - poultry, 151-157
- Grading and packing eggs, costs of, 90
 - facilities and systems for, 83-85
- Grading eggs on farm, 264

Grange, National, 32
 Grass eggs, 50
 Green rots, 61
 Grocers, independent retail, 207
 Guineas, 121

Handlers, types of, 22
 Handling, rough, of eggs, 61
 Haugh units, 43
 Heat, effect of, on eggs, 56
 Heat spot, 57
 Hebrew holidays, 119
 Hedging, 235
 Hemoglobin, 45
 Hens, 120
 Hotel-supply houses, 26
 Hucksters, 23
 Humidity, 46, 59
 Hydrogen-ion concentration, 47

Ice packing, 161
 Icing instructions, 191
 Imports, 12
 of egg products, 96
 Income, gross farm, 2
 Incubation temperature, 57
 Infection, bacterial, 54
 Infertile egg, 58
 Informational facilities, 29
 Inheritance, 48
 Institute, American, of Cooperation, 278
 Institute of American Poultry Industries, 30
 Integration, 27
 Internal conditions affecting egg quality, 48
 International Baby Chick Association, 254
 Interstate Commerce Commission, 191

Jobbers, 25

Keeping qualities of eggs, 49
 Killing, methods of, 130
 Kosher, holiday demands, 119
 poultry, 117

Labeling requirements for shell eggs by states, 306, 307

Lading, order bill of, 192
 straight bill of, 192
 Latebra, 41
 Laws, *see* Legislation
 Lay, rate of, 5
 Layers, of albumen, 43
 of shell, 45, 46
 Leakers, 63, 68
 Lecithin in yolk, 47
 Legislation, cold-storage egg, 283
 discriminatory, 286
 do's and don'ts of egg and poultry, 291
 early egg and poultry, 283
 effecting farmer cooperatives, 310
 enforcement of egg and poultry, 291
 fresh egg, 284
 importance of repealing obsolete egg and poultry, 290
 preparation of fresh egg, 285
 prospects for changes in egg and poultry, 282
 states having, requiring refrigeration of eggs, 294
 to improve quality, 287-289
 trade attitude toward egg, 290
 types of egg and poultry, 282
 see also Laws
 Licenses, certificates, or permits for egg dealers by states, 308, 309
 Liquid eggs, 94
 Live poultry, commission merchants, 116
 country assembly of, 114
 handling, in the markets, 115
 in New York City, 115
 marketing channels for, 114
 receipts of, 113
 standards of quality and grades for, 122
 types of, 120, 121
 U.S.D.A. standards of quality for, on individual bird basis, 122
 see also Poultry
 Livetin in yolk, 47
 Loading privileges by carriers, 190
 Lysozyme, 43

Magnesium carbonate, 46
 in feed, 50
 Mammillary layer in shell, 45, 46

- Margins, marketing, and costs, 216-224
 - for eggs, 217-220
 - for frying chickens, 221-223
 - for poultry, 220-224
 - for turkeys, 223, 224
- Market, domestic, 9
 - eggs, deterioration of, 54
 - foreign, 11
 - information, 238
 - price, 39
 - reporting the New York, 241
- Marketing, commodity, associations, 277
 - farmer cooperative, associations, 274
- Marketing activities, 16
 - integration of, 27
- Marketing channels, 16, 20
- Marketing margins and costs, *see* Margins
- Marketing operations, start of, 205
- Marketing, programs, 211
 - operations, start of, 205
 - services performed by producers, 269-279
- Market reporter, Urner-Barry Company as a, 242
 - U.S. Department of Agriculture as a, 242
- Market reports, 239-245
 - Producers' Price-Current*, 242
- Markets, types and conditions of, 240, 241
- Materials handling, 85
 - crew balance for, 86
 - mechanical equipment for, 87
 - movement of supplies for, 88
 - plant layout for, 89
 - preventive maintenance for, 88
 - unit load for, 87
- Meat spots, 50, 52
- Membrane, shell, 45
 - vitelline, 41
- Minnesota Poultry, Butter and Egg Association, 32
- Moisture, 46
- Molds, 60
- Molt, effect of, 49
- Motor Carrier Act of 1935, 191
- Mottled and blemished yolks, 49
- Multigerminial discs, 51
- Mustiness, 60
- Naked eggs, 82
- National, Broiler Council, 257
 - Council of Farmer Cooperatives, 31, 278
 - Egg Products Association, Inc., 32
 - Grange, 32
 - Poultry, Butter and Egg Association, 31
 - Poultry Council, 253
 - National Egg Day and Week, 253
 - Poultry Producers Federation, 31
 - Turkey Federation, 256
- Newcastle disease, 49
- New England Fresh Egg Institute, 255
- New-laid eggs, 42, 48
- North Central States Institute, 32
- Northeastern Poultry Producers Council, 31
- Odors, absorption of, in eggs, 63
- Off-flavor eggs, 49
- Oiling eggs for shell protection, 74, 264
- Olive-colored yolks, 50
- Ovarian conditions, 50
- Oviduct conditions, 52
- Ovoalbumen in egg, 47
- Ovoglobulin in egg, 47
- Ovomucin in egg, 47
- Ovomucoid in egg, 47
- Ovovitellin in yolk, 47
- Pacific Dairy and Poultry Association, 32
- Packages, poultry, 157-161
 - shell egg, 78
- Packaging poultry, 157, 158
- Packer branch houses, 26
- Packing, 17
 - ice and dry, of poultry, 161
- Packing and grading eggs, costs of, 90
 - facilities for, 83-85
 - systems for, 84, 85
- Packing materials, egg, 78-83
- Pan method of drying, 104
- Pasteurizing, 103
- Peddlers, itinerant, 209
- pH, 53
- Picking, *see* Feather removal
- Pigeons and squab pigeons, 121

- Pink whites, 50
- Plant layout and facilities, 143
- Plants, poultry canning, 166
 - slaughtering, 24
- Pores of shell, 46
- Porosity of shell, 49
- Poultry, by-products and wastes, 165-172
 - canned, 163
 - chilling, 137-142
 - use of antibiotics when, 142
 - condition of dressed, 151
 - cut-up, 140
 - determining the grade of dressed, 155
 - freezing, 142
 - frozen, in storage, 199
 - grading and packing, 151-157
 - kinds of, 120, 121, 151
 - legislation concerning, 281
 - marketing margins and costs for, 220-224
 - marketing services preformed by producers of, 270
 - market quality of dressed, 153
 - packages for, 157-161
 - per capita consumption of, 214-216
 - preparing ready-to-cook, 137-140
 - processing, 129
 - receipts of processed, 176, 178-181
 - retailing, 212
 - washing, 137, 140
 - weight specifications for, 155
 - see also* Live poultry; Processing poultry
- Poultry and Egg National Board, 35, 255
- Poultry Breeders of America, 32
- Poultry meat, consumer preferences for, 214
- Poultry products, 163
 - for food, 163
 - industry, 163
 - nonfood, 165
 - processed and canned, 163
- Poultry Products Inspection Act of 1957, 126
- Poultry Science Association, 32
- Price, cycles, 236
 - determinants, 227
 - forecasting, 237
- Price, variation, 230
- Prices, 226
 - current, 226
 - determining, for sales, 233
 - farm, 232
 - monthly farm, for eggs and egg products, 101
- Processed eggs, *see* Oiling eggs
- Processing poultry, 129
 - calculations of costs for, 146-148
 - chilling for, 137
 - cropping and cleaning vents for, 137
 - eviscerating room for, 143
 - feather removal for, 131
 - by dry picking, 131
 - by mechanical picking, 134
 - by scalding, 132
 - by skinning, 131
 - grade yield when, 147
 - holding and feeding room for, 129
 - killing methods for, 130
 - procurement for, 129
 - seasonality of, 127
 - shrinkage during, 147
 - singeing for, 137
 - washing for, 137
- Producer, basis of pay for, 203
- Producers, marketing services 'performed by, of eggs and poultry, 269-273
- Producers' Price-Current*, 242
- Producer-to-consumer sales, 269
- Production, desirable, practices for eggs and poultry, 262
 - farm, by regions, 3
 - per capita, 10
 - point of, 201
 - seasonality of, 5
- Promotion, agencies, 251-258
 - early efforts in, 252
 - experiences and problems in, 252
 - industry's support of, for eggs and poultry, 250
 - state and regional limitations of, 252
- Promotion and advertising, 247
- Promotions, outlook for future, 259
 - reasons for failures, 258
- Protected shell-eggs, *see* Oiling eggs
- Protein content of albumen, 43
- Pseudomonas* (fluorescent bacteria), 61

- Pullet flocks for producing eggs, 49, 77
- Pullets, 120
- Quality, conservation of egg, 262
 - control of, 76
 - exterior egg, 62, 66
 - interior egg, 47, 66
 - keeping, of eggs, 49
- Quotations, 241
- Rail transportation, 175-195
 - preparing cars for, 185-188
 - see also* Transportation
- Ready-to-cook poultry, 137-140
- Receivers, 25
- Refrigerated warehouse facilities, 194
- Refrigeration, states having laws or regulations requiring, of eggs, 295
- Refrigeration in transit, 188
 - types of, 188, 189
- Regulations, states having, requiring refrigeration of eggs, 295
- Reports, market, 239-245
 - national, 242-245
- Retail, grocers, 206
 - handling of eggs, 210
- Retailers, 27
 - classes and types of, 206-210
- Retailing eggs and poultry, 206-216
 - poultry, 212-216
- Riboflavin in egg albumen, 47
- Risk, assuming, 18
- Roadside stands, 209
- Roaster, ducklings, 121
 - turkeys, 120
- Roasters, 120
- Roosters, 120
- Rots, 60, 70
- Sales, future, 29
 - producer-to-consumer, 269
 - types of, 233, 234
- Salmonella bacteria, 103
- Scalding poultry, 132
- Scale, Haugh unit, 43
- Schools, egg grading, 73
- Selling, 18
- Separation of yolks and whites, 102
- Services, 201
 - governmental, 30
- Shapes of eggs, abnormal, 54
 - factors affecting, 62
 - for grading, 66, 72
 - inheritance of, 48
- Shell, characteristics of, 41-50, 66-76
- Shell-less eggs, 82
- Shell-protecting eggs, 74, 264
- Shell-treated eggs, 74, 264
- Shipper, 24
- Shipper's specified service, 191
- Size and weight specifications for shell eggs by states, 296-303
- Size of eggs, factors affecting, 62
 - for grading, 66, 71
 - inheritance of, 48
- Slaughtering plants, poultry, 24
- Soft-shell eggs, 53
- Soundness of eggs, 63
- Sour eggs, 60
- Southeastern Poultry and Egg Association, 32
- Space, air (air cell), 45
- Spots, blood, meat, and heat, 49-58
- Spot sales, 29
- Spray method of drying, 104
- Squabs, 121
- Stags, 120
- Stands, roadside, 209
- Storage, cost of, 198
 - eggs, 61
 - frozen eggs in, 199
 - frozen poultry in, 199
 - location of, operations, 194
 - of eggs and poultry products, 193
 - trends in, holdings, 196
- Storage-in-transit, 191
- Storers, 26
- Stores, chain, 206
 - cut-up poultry, 207
- Storing, conditions for, eggs, frozen eggs and poultry, 198
 - eggs and poultry, 18, 193-199
- Sulfanilamide in ration, 49
- Sunlight, 50
- Supply and demand, 35
- Surplus-deficit areas, 9
- Sweating, egg, 59, 102

- Tariffs, warehouse, 197
- Temperature, effects of, 47, 54
- Tempering of eggs, 59
- Thermostabilization, 59
- Thin-shell eggs, 53
- Trade associations, 30
- Trading, future, 235
- Transit, damage in, 193
 - handling, claims, 193
 - privileges and regulations, 189-193
 - refrigeration in, 188, 189
- Transportation, rail, 175-195
 - handling cars for, 185-188
 - rates and regulations for, 191
 - receipts for, 192
- truck, 175-188
 - see also* Truck transportation
- Transporting, 17
 - eggs and poultry, 174-193
- Trays, 81
- Tremulous air cells, 61
- Triple-yolk eggs, 51
- Truck transportation, 175-188
 - by city delivery, 185
 - by country pick-up, 177
 - by over-the-road tractor-trailer, 184
 - precooling and preheating for, 185
- Turkey Federation, National, 256
- Turkeys, 8, 120, 121, 182, 183
 - marketing margins and costs for, 223
 - market types of, 120, 121
 - packaging, 157
 - receipts of processed, 182, 183
 - types of, to produce, 268
- Ultraviolet rays, 61
- U.S. Department of Agriculture as a market reporter, 242
- United States Egg Society, 254
- United States standards of quality for individual shell eggs, 41, 67, 68
 - Plates I and II showing, between pp. 42 and 43
- Urner-Barry Company, 242
- Uterus, 45
- Utility, law of diminishing, 37
 - marginal, 38
- Vending machines, selling eggs by, 267
- Vitamin D, 50
- Vitelline membrane, 41
- Warehouse, refrigerated, facilities, 194
 - tariffs, 197
- Warehouses, cold-storage, 61
- Washing, eggs, 45, 102, 263
 - poultry, 137, 140
- Weight, size and, specifications for shell eggs by states, 296-303
- Western Poultry Congress, 32
- White rots, 60
- Whites, bloody, 51
 - separation of yolks and, 102
- White-shell eggs, 48
- Wholesale dealers, 25
- World's Poultry Congress, 33
- World's Poultry Science Association, 32
- Xanthophyll in yolk, 47
- Yolk, cholesterol in, 47
 - condition of, 66
 - fatty substances in, 47
 - freezing, 104
 - glycerides in, 47
 - lecithin in, 47
 - ovovitellin in, 47
 - pigment in, 47
 - types of processed, 107
 - xanthophyll in, 47
- Yolks, crusted, 61
 - misplaced, 51
 - mottled and blemished, 49
 - olive-colored (grass), 50
 - separation of, and whites, 102
 - water blisters on, 49

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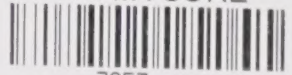
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